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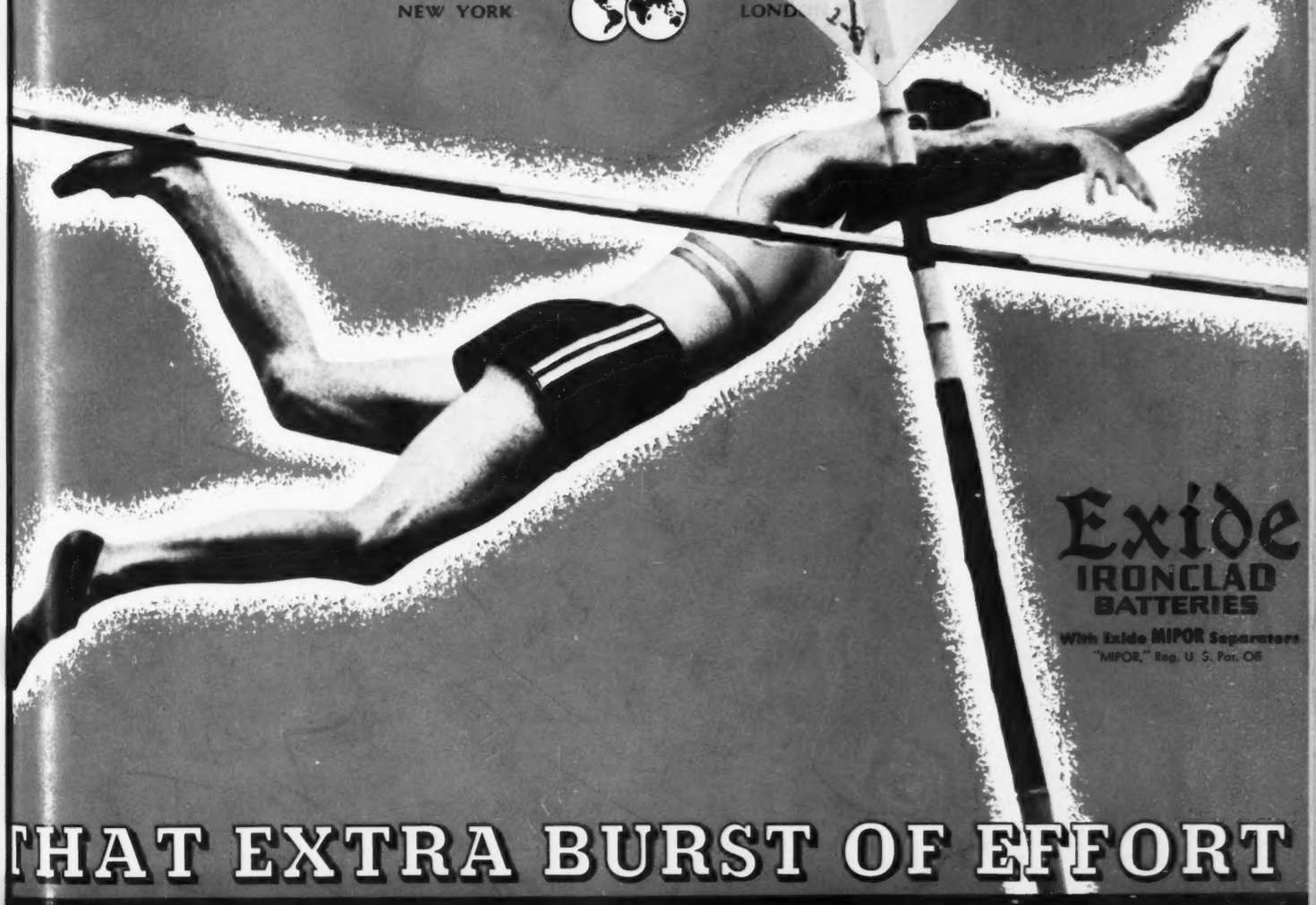

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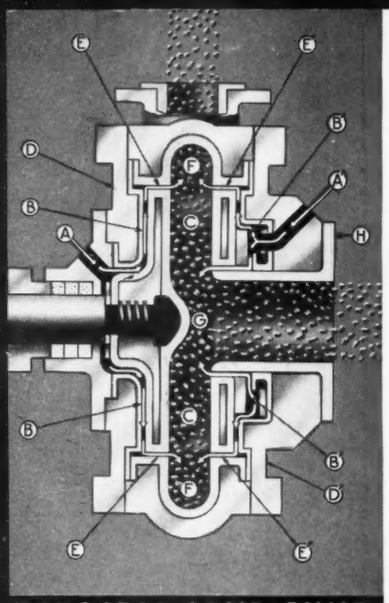
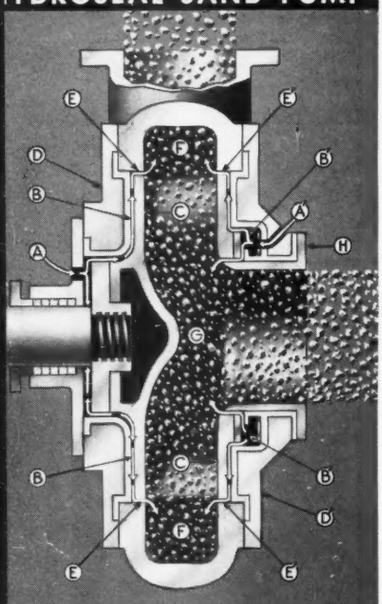


YDROSEAL SAND PUMP



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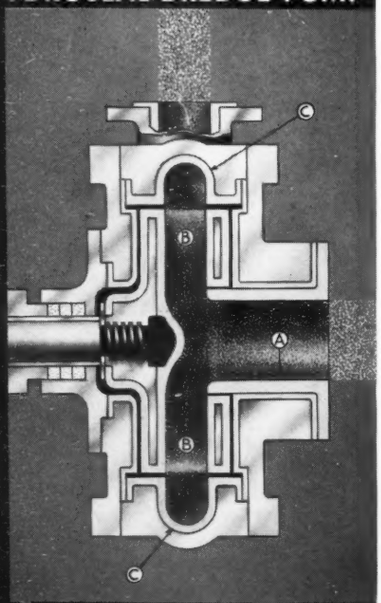

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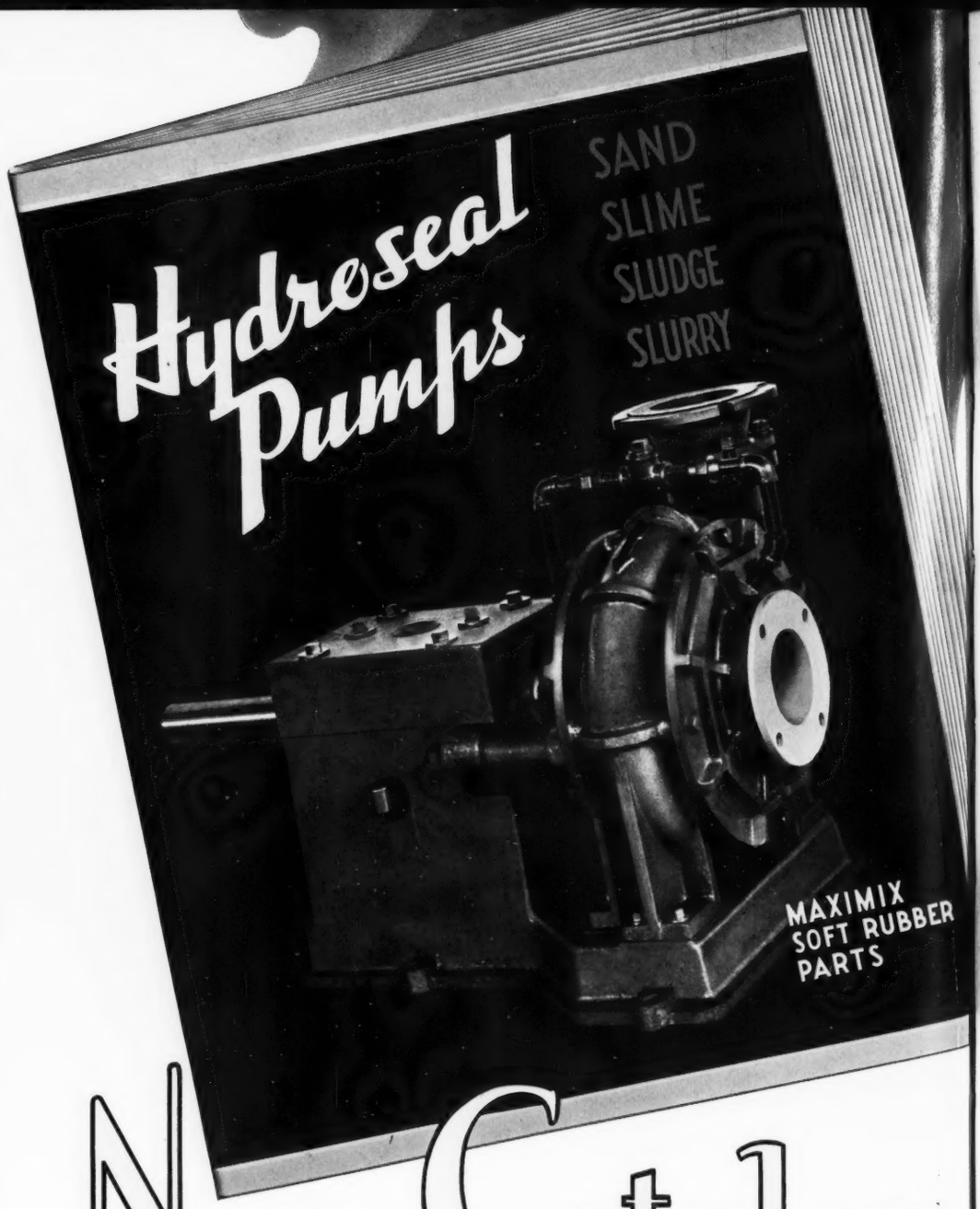

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WILLARD CHEVALIER
Vice-President

The Old Adage about the certainty of death and taxes is given force by a nation-wide survey of 694 companies in 25 leading industries, by the National Association of Manufacturers. The results show that taxes amount to 34 per cent of payrolls, 8 per cent of sales, $486 per employee, $303 per common stockholder, and 142 per cent of dividends. Taxes were heaviest in the petroleum industry, where seven companies reported levies amounting to 120 per cent of payrolls. Quick, Watson, the needle!

✲

Lucky John gravel mine operators, in Butte County, Calif., do their sluicing underground, running the gravel taken out in room-and-pillar mining through an inclined ditch on bedrock to a chute raise, from which it is loaded into mine cars and hauled through a 2,000-ft. tunnel to the dump. Not so new as interesting. Glenville A. Collins, president of the company, will describe the work next month.

✲

Equipment or Taxes? Under the new revenue act a heavy tax is placed on undistributed profits. But expenditures for equipment may be deducted before the profits are computed for taxation. This, together with the retention of the excess profits tax, is expected to stimulate the purchase of machinery. Here is an opportunity to modernize the plant. Better spend some of the profits that way than for taxes.

✲

Boarding House Item. The daily ration for native labor in the Rand laid down by government regulation consists of 24 oz. maize meal, 6 oz. bread, 3 oz. beans or peas, 2 oz. peanuts or ½ oz. fat, 5 oz. vegetables, 1/6 oz. coffee or cocoa with sugar, and, in addition, 3¾ lb. meat per week with sufficient salt.

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Resurrected after 24 years, the *Boletin*, or Bulletin, of the Mexican Geological Society emerges from its office of publication on Calle del Ciprès (No. 176) in Mexico City as Number 1, Volume IX, resuming where it left off in 1912 after the first part of Volume VIII had appeared. From now on, however, each annual volume is to contain ten parts instead of two, as before. The missing Part Two of Volume VIII is to appear immediately with the material that remained unprinted in 1912. A grand example of persistence in publication!

✲

This Government. American public affairs are managed by approximately 175,000 separate Federal, State, and local governments, according to a report to the President by the National Resources Committee. It urges cooperative endeavor to lessen administrative duplication. The inference is that we might be better off with less government and more management. Somehow we are reminded of the metallurgical process which was criticized as being "over-invented and under-engineered."

✲

Autogenous Smelting of copper concentrates with elimination of the roasting phase is the previously mentioned subject of an article which, after some delay, will start next month. The author is T. E. Norman, of Toronto.

✲

The Transvaal Chamber of Mines, famous and efficient institution of Johannesburg, engages in a wide array of activities in behalf of the gold-mining industry of the Rand. But, reader, take notice: it does not act as an employment agency for the mines (despite which it receives hundreds of applications annually) and it won't advise anyone who wants to take a flyer in stocks.

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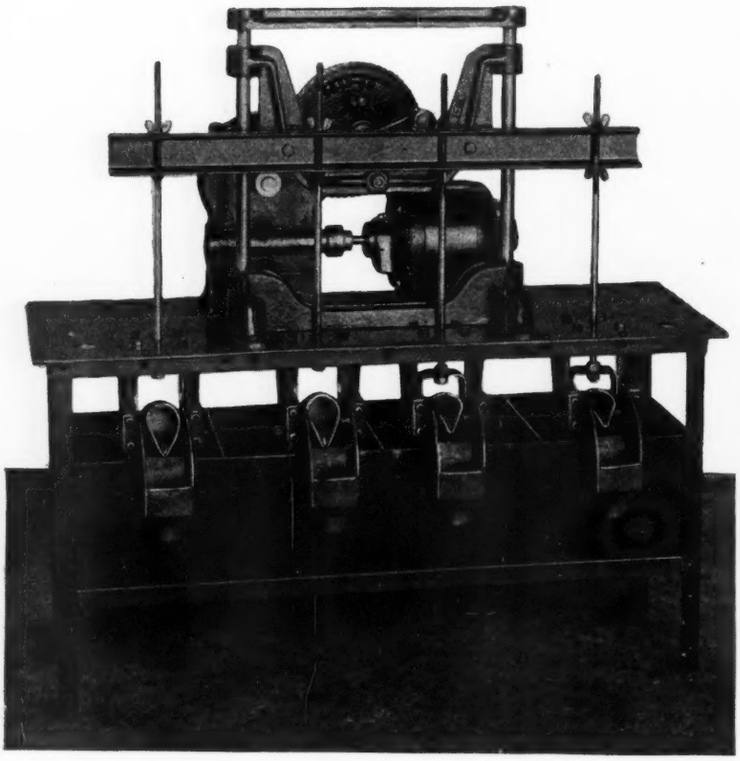

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Volume 137 SEPTEMBER 1936 Number 9

Revival of Consumption of Non-Ferrous Metals

ATTEMPTING TO APPRAISE the mining outlook last February, we said: "Barring unforeseen events, the prosperity that has prevailed in gold and silver mining should extend this year to the major non-ferrous metals." Looking backward from the vantage point of September we observe that expectations have been so fully realized that 1936 now promises to stand out boldly as a period of substantial improvement in the domestic consumption of copper, lead, and zinc. This follows the pattern in European countries where consumption of the non-ferrous metals in recent years has been quite pronounced.

Apparent consumption (shipments to consumers) of copper, lead, and zinc in the United States for the first seven months of 1936, compared with the same period last year, shows marked improvement. The figures are given below in short tons.

	January-July	
	1935	1936
Copper	275,000	397,000
Lead	230,000	254,700
Zinc	247,300	294,400

This improvement in demand points definitely to expansion in general business activity, which now embraces the heavy industries. The electrical industry, heavy consumer of copper, is exceptionally active. Utility sales of energy thus far in 1936 are up 16 per cent over the corresponding period of 1935 and 22 per cent over 1929. Manufacturers report sales of electrical equipment above bogies, with business still on the up-grade. *Electrical World* characterizes this condition as "necessity buying." The automotive and construction industries are also prime factors in stimulating trade in metals, and both are unusually active. After a five-week inspection of construction activity in the Western States, *Engineering News-Record* reports increased residential building.

Copper and zinc have fared better than lead thus far in 1936, as shown in the table. But purchases of lead in July and August were well above the monthly average for the first half of the year, and the industry believes that demands of consumers in the second half will exceed those of the first six months. Good news for lead producers is found in increased manufacture of lead-covered cable. This use of lead may not exceed 55,000 tons this year, and for some time to come is not expected to approach the extraordinary consumption of 220,000 tons in 1929, but it will show an improvement over the 1935 record of 37,800 tons.

Consumption of copper in 1936 certainly looms large. Market activity in this metal has been given an extra stimulus by the steady upward movement in price. Doubtless all of the metal shipped has not been actually consumed, and invisible supplies in the hands of fabricators and distributors must have been augmented. But copper producers believe that these invisible supplies were permitted to fall to a dangerously low level during the depression and that heavy buying at this time may not affect the future market unfavorably. The constant threat of a European conflict necessarily makes for a nervous market for copper, particularly abroad; but as long as business continues its upward trend and production and consumption are about in balance, confidence in the market is not likely to be easily shaken. In fact, the world-wide move to increase copper production makes for an orderly market under prevailing conditions.

Except for the threat of foreign zinc jumping our domestic tariff hurdle, because of the disorganized foreign market and the difficulties that stand in the way of renewing the Cartel, domestic producers of the metal would be in a position to reap some benefit from what all agree is an excellent statistical showing. Surplus stocks have been reduced to about normal. A moderate advance in the price, one that would not be burdensome to consumers but at the same time helpful to producers of both metal and ore, would soon follow the event of price recovery abroad.

Silicosis Surcharge in California

ON JUNE 1, 1936, the silicosis surcharge on compensation insurance rates, as announced early in May in a decision by Insurance Commissioner Samuel L. Carpenter, Jr., went into effect in California. Explained briefly, the ruling reduces manual rates on underground mining and ore milling slightly, and adds a surcharge to all mining classifications, except bucket-line and dragline dredging, and about 60 other industries. For surface mining, underground mining, and ore milling the surcharge on the new manual rates of $9.15, $10.97, and $2.84 on each $100 of payroll is $0.56, $2.24, and $1.40 respectively. Though this additional levy is but a fraction of the amount originally requested by the California Inspection Rating Bureau, most mine operators in the State are concerned about the burden imposed upon them by the new measure, and consider the silicosis insurance problem as disconcerting as ever. Operators of small and marginal properties in particular will find it difficult to absorb a part of the $125,754 to be paid in premiums to insurance companies in the next twelve months under the new ruling. In fact, it seems to be the general opinion that the small operators are discouraged and are withdrawing, and the larger companies are assuming a conservative attitude with reference to future extension of operations and plant equipment.

Although a certain amount of relief is being granted by the provision of a rating plan under which the insured may obtain a reduction of from 1 to 50 per cent of the surcharge by instituting effective dust-control measures, California mine operators rightly consider the present rates exorbitant and unfair. In view of the fact that the record of hearings failed to indicate that there is any appreciable silicosis risk in the mines of the State, and the actual experience cost records of silicosis is only one-seventh of 1 per cent of total insurance costs, this contention seems justified.

California mine operators are unanimous in their desire to see the workers protected from every possible hazard and are willing to pay a reasonable and just rate for such protection, provided the problem is approached fairly and cooperatively, with silicosis rates based upon California experience rather than upon conditions prevalent in other states. Though it is true that the danger of silicosis exists in a comparatively small proportion of mining properties, it can be said that conditions in general are not such as to call for drastic regulation now, nor for the abuses of excessive insurance rates, with attendant increased costs at all mines.

SEC Proposes New Exemptions for Mining Companies

IT HAS BEEN RECOGNIZED for some time that existing regulations and registration forms of the Securities and Exchange Commission were ill suited to mining companies, particularly those in the promotional stage. However satisfactory the requirements may have been for industrial companies, they were not appropriate to the business of mining. They were not always clear and intelligible, with the result of irritating delays and time-consuming correspondence over deficiencies in the registration statements. On the whole, there was a feeling in the mining industry that legitimate promotion and development were being needlessly handicapped by SEC.

In a desire to meet this criticism, SEC is considering the adoption of new regulations and registration forms that will simplify procedure for mining companies. Last month our Washington correspondent quoted extensively from a letter of Chairman Landis, which had been sent to a limited number of mining men, outlining the proposed changes and requesting comment and criticism. We have had an opportunity to read the proposed new regulations and registration forms and believe that their adoption will go far toward removing existing causes of complaint.

They give substantial recognition to the method of mining promotion so common in Western communities —selling small issues of stock locally in compliance with local requirements. If such issues amount to less than $100,000 the Commission proposes to exempt them from any Federal requirements. If the stock is to be sold in more than one state, so that compliance with several local laws might be difficult, all that will be necessary is to file a statement on the proposed new form in order to comply with the provisions of the Securities Act of 1933.

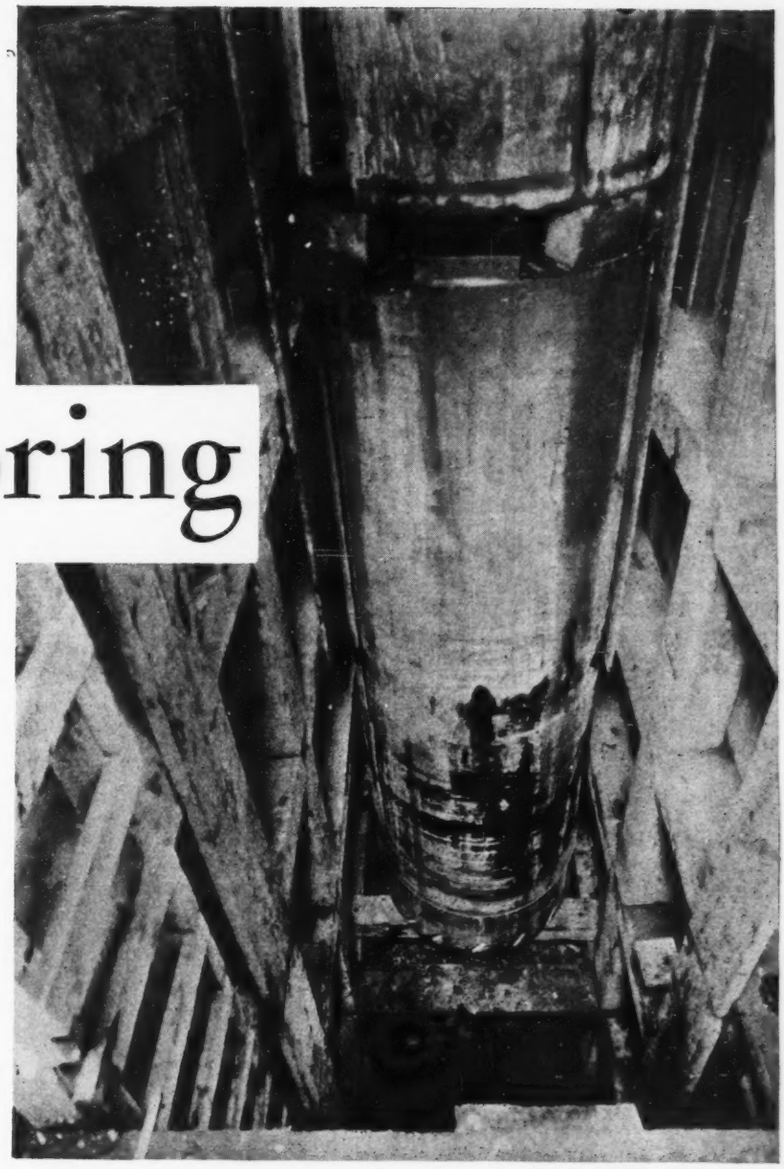
The proposed registration form requires only such information as any prospective investor might legitimately demand—description of the property, development program, proposed use of funds, promotion and underwriting expenses, and similar items. The financial section of the form has been simplified; and certain answers to questions regarding expected costs of operation need be answered only if the registrant claims the existence of "proven" or "probable" ore.

It is doubtful if any registration form can be devised that will not appear in some degree formidable to those who use it for the first time. Also, it is likely that the registration process will be irksome even to some honest promoters who find it necessary to comply with the Securities Act. But it must be remembered that the mining industry has long been the happy hunting ground for unscrupulous promoters, who must be curbed in the public interest. This the SEC has done effectively. It now proposes to simplify its requirements of legitimate promoters without relaxing its vigilance with respect to the wildcats that have so discredited mining ventures. It is to be hoped that the new regulations and registration forms will soon be adopted, and that they will encourage legitimate mining promotion.

IDAHO–MARYLAND sinks 5-ft. circular vertical opening 1,125 ft deep with novel machine that is supported and operated from within the hole. . . . Core is removed in sections up to many tons in weight

Shaft Boring Found Inexpensive And Safe

J. B. Newsom
Mining Engineer
Grass Valley, Calif.



THE CORE BARREL, 15 ft. in length, which is attached to the lower end of the vertical driving shaft. Forty-two feet of overburden was mined in the usual way and supported with timber as seen here. The rest of the shaft was bored with this machine

VERTICAL SHAFTS in the United States have heretofore been sunk by blasting and mucking. The blasting leaves uneven, shattered walls which must usually be supported. Even though the walls will stand, shaft lining is needed to furnish supports for the cage guides, pipes, and power conduits. The lining is generally timber, and as timber can be most easily framed into rectangles, rectangular shaft openings are the rule. The timber reduces the size of the cage floor. For example, if the Idaho Maryland company had put down No. 2 shaft by blasting and mucking, the cage area would have been about 30 per cent of the total shaft area. Besides a low percentage of useful area, an ordinary shaft is subject to fire hazard and to timber-maintenance charges. It is also poor for ventilation because the timber ribs cause eddies which greatly reduce the speed of the air currents.

A bored shaft does not have these disadvantages. Inasmuch as the walls are smooth, circular, and not shattered by blasting, lining is not required in most ground. Guides and columns can be fastened directly to the rock walls by stud bolts. The cage area is 79 per cent of the total shaft area. When steel cage guides are used, such a shaft has the further advantages of being fireproof and free from timber-maintenance charges. Also, being circular, with smooth sides, it is much better for ventilation. Preliminary figures indicated that a bored shaft would be less expensive and that the sinking operation would be considerably safer. Increased sinking speed was also indicated.

To prove these various points, the Idaho Maryland Mines Corporation recently bored and equipped a circular shaft 5 ft. in diameter and 1,125 ft. deep at Grass Valley, Calif. The site chosen for the work had the following advantages:

It offered many types of ground: an abrasive gabbro; swelling ground; gouge, blocky serpentine; and firm serpentine. The site was away from the main surface plant, so experiments did not interfere with other work. The shaft passed near mine workings at the 500-ft., 750-ft., and 1,100-ft. levels. An air and timber shaft was needed at the site chosen.

I had used a large-diameter core drill, and had trouble with the drill rods whipping in the hole. Connecting and disconnecting the rods had consumed much time. Also, drill rods are expensive, a string a thousand feet long costing several thousand dollars. These various difficulties had led me to design a drill which could be lowered into the drill hole on the end of a cable, eliminating the rods. This drill consisted of a cabin containing a motor, the driving mech-

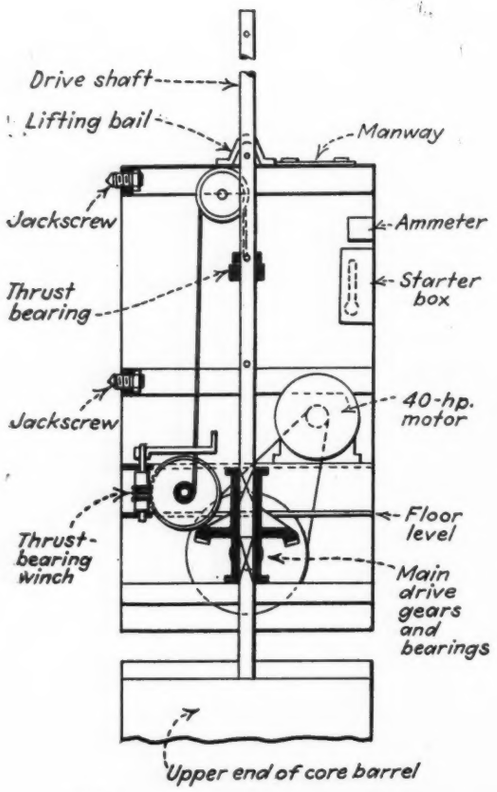
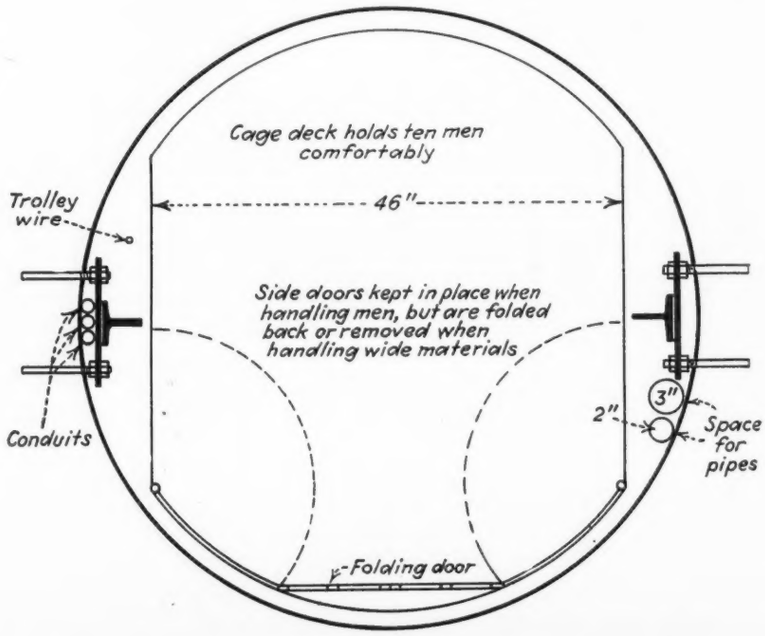
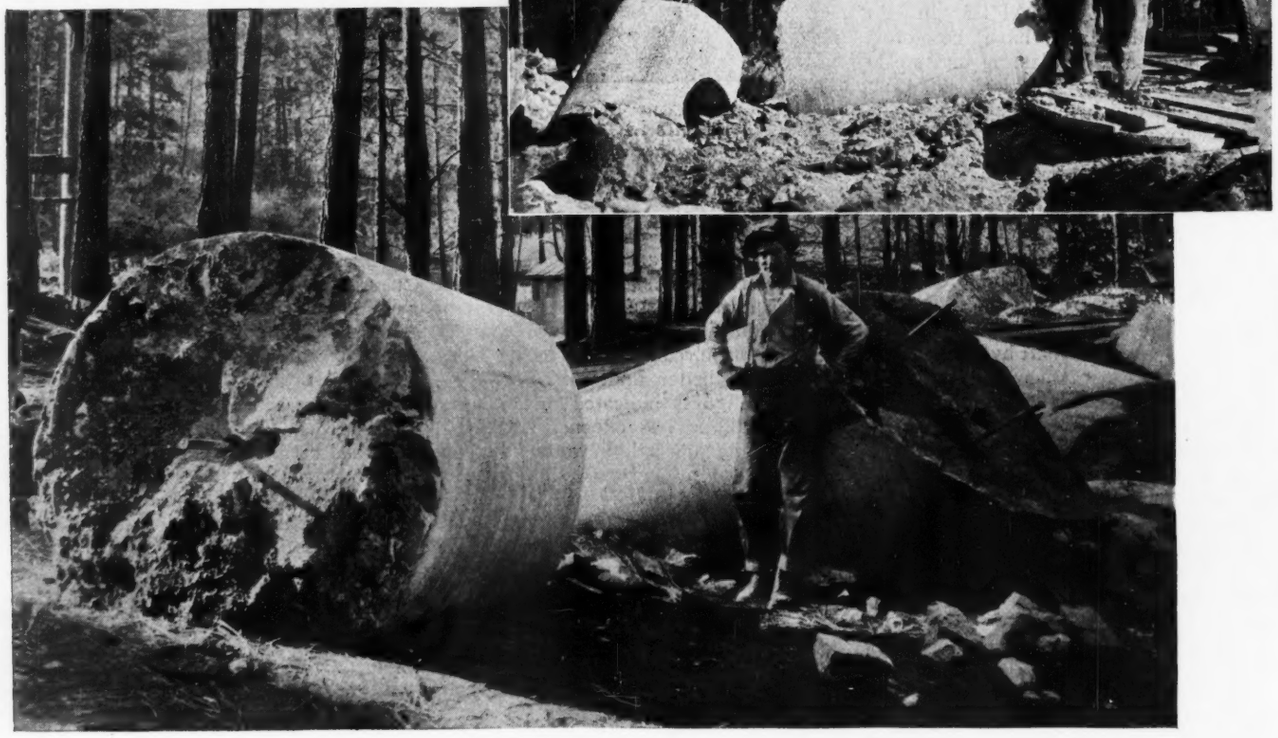


Fig. 1. . . . THE SHAFT DRILL MECHANISM in generalized cross-section. Note the jackscrews. Six of these are provided and can be forced out against the sides of the hole to hold the cabin and its machinery securely in place

Fig. 2. . . . COMPLETED SHAFT CROSS-SECTION, in outline. The cage deck, 46 in. wide, will hold ten men comfortably. In the space between the sides of the cage and the circular wall are the guides, pipes, and conduits supported directly by the rock



CORE FRAGMENTS taken from the 5-ft. diameter bored shaft by a specially designed combination core puller and core barrel. They are of gabbro and are about 7 ft. long, weighing approximately 11 tons each



anism and controls, and a seat for the operator. The cabin was supplied with six screw jacks which could be forced out to fasten it securely in place against the sides of the drill hole. The operator stayed in the cabin all the time during the drilling operation. He was protected by a roof of ½-in. steel plate.

The drive unit was a constant-speed 40-hp. motor, which transmitted power through a chain drive and conical gears to a vertical splined shaft which extended up through the center of the cabin. A movable thrust bearing was fixed on this splined shaft, and the operator had a control mechanism by which he could raise or lower this vertical bearing, controlling the weight on the cutting shoe. In addition to the vertical feed control, an ammeter in the cabin indicated how much friction the drill was developing. The motor was protected by overload and no-voltage releases.

A core barrel 15 ft. long was attached to the lower end of the splined shaft. Detachable cutting shoes were fixed to the bottom edge of this barrel. In practice, these shoes failed, and were replaced by a solid cutting ring riveted in place.

The first work done brought out the following points:

1. The machine would cut rock at the rate of about a foot an hour.

2. A crew of skilled operators was vitally necessary to successful operation. Inasmuch as this was a new development in mining, skilled operators were not available, and men had to be trained for the work. Later developments indicated that inexperience was one of the main reasons for the slow progress at the beginning of the job.

3. In hard rock the machine would not deviate from a straight line. This proved annoying, as we had thought we could turn the hole by drilling to one side, so had not taken pains to plumb the machine accurately at first. The hole was finally straightened by blasting out one side of the bottom and re-collaring the drill.

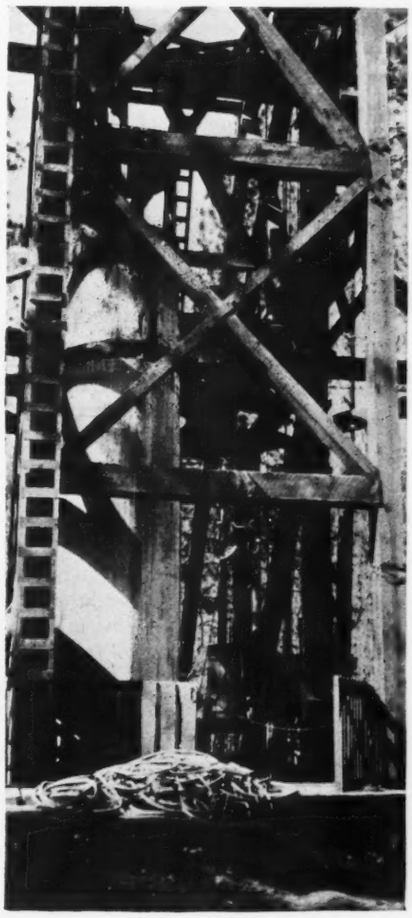
4. It was easy enough to break off cores, but not so easy to bring them to the surface in large pieces. Inasmuch as one of the main economies expected was the elimination of mucking, this seemed a serious drawback. This difficulty of bringing up large pieces was overcome later.

5. The sides of the hole would stand well without support in most ground.

6. If the men knew what they were about, the method was safe, but with unskilled men it was extremely hazardous.

7. The basic design of the machine was right, but it was under-powered and the auxiliary equipment had to be developed.

To describe the many discouraging delays encountered or the mistakes made before faith in the process seemed justified is not worth while. In the first three and a half months of drilling three shifts per day half of the time, a shift and a half the rest of the time, only 44.6 ft. of shaft was drilled. At the end of this period better progress was made, the shaft advancing 84.8 ft. in the next two months. The operating cost being about $1,500 a month, this was more encouraging as to cost, but still not fast enough as to sinking rate to be of real value.



DRIVE HEAD and core barrel hoisted above the shaft collar and suspended in the headframe. Detachable cutting shoes were originally fixed at the bottom edge of the barrel. They failed, however, and were replaced by a solid cutting ring riveted in place

By the time the second period was finished, the shaft had been deepened to the limit of the hoisting equipment, so new surface tackle and a new hoist were installed. During the next three months, the shaft was deepened 249 ft., or an average of 83 ft. a month. At this point, very heavy ground was encountered, which had to be supported with reinforced concrete. Seventy-four feet of this was drilled and cemented in two months.

By this time the shaft extended 506 ft. below the collar, and after sinking another 40 ft. to provide a sump, operations were stopped to cut the 515 level station through from other workings.

When drilling was resumed, 162 ft. were sunk in 34 days, a rate of 147.5 ft. a month. During this last drilling period we found that the hole had again deviated from the vertical in the heavy ground. This could be understood, because during that work the bottom of the hole often widened beyond the bottom of the drill shoe. To straighen it, enough of the shaft wall was moiled out so that the machine could be set vertically again. This moiling took ten days.

The succeeding months were devoted to technique and to answering important questions. This made the speed and cost records suffer, but many problems were solved.

The last time the direction of the hole was turned, mainly to see if it could be done easily, the cost of the lost time was $9.85.

In bad ground cores would sometimes fall apart so completely that a band could not be placed around them to pull them to the surface, and they had to be mucked out. A combination core puller and core barrel which was designed to solve this problem at first caused trouble, as the pulling dogs were on springs which it took nearly a month to learn to adjust easily. However, when this was mastered the device proved satisfactory, and better than average sinking speed was made in spite of the fact that lack of hoist capacity prevented pulling long cores.

Trouble with rope spin during hoisting and lowering was also eliminated and methods were developed for handling the electric power cable and signal wire easily. During the last sinking period air conditions became troublesome. A small air hose lowered to the bottom of the shaft solved this difficulty.

The crew consisted of two men per shift, a drill runner in the hole and a helper on the surface. The helper ran the hoist. There were three shifts a day, this making six regular men. The operation was supervised by a foreman who, necessarily, was an experienced drill runner. Drill runners were paid $5.25, helpers $4.40 per shift, and, in addition, a dollar a foot sunk was divided among the drillers and helpers.

As a safety precaution, the shaft walls were tapped from top to bottom once a week. In addition, safety hoods of ¼-in. plate were mounted on the hoist lines just over the men, so they were almost never exposed to danger from falling objects. No hoisting was ever done over a man. Although the rope safety factors were high, men were not allowed to ride on heavy loads, such as the drilling machine or a core.

The drilling cycle was as follows: (1) Put the drill in the hole and line it up. (2) Drill till the core is cut to its full depth. (3) Remove the drill from the hole and set it back out of the way.

(4) Bail out the water and cuttings. (5) Break off the core. (6) Attach the core hoisting tackle. (7) Hoist and dump the core. (8) Bail out the water and cuttings which were in the drill kerf during operation (4). (9) Inspect the bottom of the hole and remove any broken pieces which would interfere with drilling the next core.

The combination core barrel and core puller not only cut the core but also lifted it out of the hole, greatly reducing the time consumed by operations (4) to (7) above.

As mentioned, swelling ground was supported with reinforced concrete. The method was to dig out the bad ground until there was a cavity four or more inches deep, to place reinforcing bars in this cavity on about 12-in. centers, sticking the ends of the bars into holes drilled in the sides of the cavity, and then to fill it with concrete. The concrete was poured behind a steel form consisting of a single rolled plate 4 ft. high and rolled to 5 ft. diameter, but with the edges overlapping and fitted with expansion bolts. The form could be contracted to a diameter of 4 ft. 6 in. or expanded to a diameter of about 5 ft. 2 in. Twenty-four hour cement, mixed three to one with river sand, was used. A leaner mix proved unsatisfactory, as it was slow setting and the sand washed out of it in a few places. The concrete was taken down the shaft in galvanized pails.

This method was simple and satisfactory. Some of the concrete has been in place over a year (June, 1936), and shaft inspections have not discovered any weaknesses in the concrete or the rock next to it. Reinforcing may not be necessary, as apparently the main thing is to seal the air away from the walls. It may be that time and reinforcing could have been saved by using gunite, but this was not tried.

In summarizing the results of the sinking operations, these points seem worthy of attention:

The method is inexpensive. When it is considered that a single man was used underground, that almost no powder was used, and that nearly 150 ft. were sunk in a thirty-day period, the economy will be apparent.

In the hands of skilled operators, the method is safe. Inasmuch as powder is seldom used, rock is not hoisted over men, and the hoist lines are equipped with heavy safety hoods, the usual hazards of shaft sinking are greatly reduced. Our record is a single broken leg and a few minor scratches.

The method has by no means reached its ultimate speed. A little over 10 ft. was the best day's record. The best continuous record was 21 ft. in three days. It is likely that in the future 7 ft. a day will be considered slow progress.

Larger shafts seem entirely feasible. Since a ten-man cage or a 7-ton skip can be used in a 5-ft. diameter round opening, it may be better to drill several 5-ft. holes than to drill a single larger one. Several small holes would make a better operating shaft, because they would be easier to support, independent in case of accidents, fireproof, and separated for ventilation. Several holes drilled simultaneously would cost little more than a single one, as one helper could serve several drillers, and no additional supervision or equipment would be required.

With proper handling equipment, stations are unnecessary to the sinking operations. Besides the drill and accessories, little equipment is needed except a hoist and a strong headframe or a derrick.

To keep the number of men on the payroll fairly constant, the crosscuts to stations were not all started at once. The guides were installed a few at a time and were run below each station as soon as blasting was completed. They are 4x4-in. x½-in. structural tees, welded together at the joints, with the joints ground smooth. The rails are welded to brackets, which in turn hang on stud bolts anchored to the sides of the shaft. The brackets are 8 ft. apart vertically, and are set out from the walls far enough so there is room for 1¼-in. diameter electrical conduits behind them.

Guides were installed from a working platform the full size of the hole, with a horizontal straight-edge above the platform to assist in orientation. Templets were cut in the floor, so if the platform could be moved up and down on the guides they were certain to be in place. Plumb bobs operated from the surface were used to orient the working platform. Guides were lowered in strings 200 ft. long, the joints being welded on the surface as they were lowered. The work went rapidly, all operations for a hundred feet of shaft taking about three shifts.

The cage floor plan is shown in an illustration. It is a single-deck cage, but is built so that two auxiliary decks can be hung below the main deck. It is equipped with safety dogs of the conventional type but with much smaller teeth than would be used for wooden rails. The safety dogs were drop-tested with the cage empty and also with a ton of weight added.

A trolley wire runs beside one of the guides, and a trolley on the cage transmits current for the bell knocker and an electric light inside of it. Thus, the cage tender need not reach outside to signal the hoist man.

A leveling contact which flashes a light when the cage floor is leveled at a station is being installed. It is hoped this will assist in spotting the cage regardless of cable stretch under varying loads. When the guide-rail installation has been completed so the extra handling tackle at the collar can be cleared away, the shaft will be protected against overwinding by power cut-out and automatic brake-setting devices.

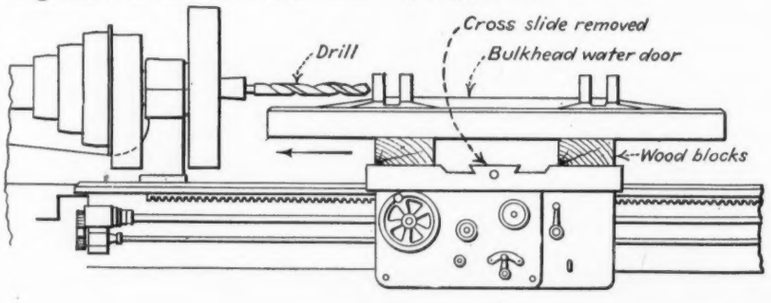
Reinforced-concrete floors, sides, and tops are being put in at the stations. It is planned to put a 2-in. water pipe down the shaft to provide water for the drills, for drinking, and for use in case of fire.

• • •

Drilling Bulkhead Water Doors in a Lathe

DETAILS of the new method used at the machine shop of Phelps Dodge Corporation, Copper Queen Branch, Bisbee, Ariz., for drilling the holes in the hinge lugs of large bulkhead water doors are explained in the accompanying sketch. Previous to the adoption of this scheme, the work was done in a large radial drill press at the shop, but John Kraetz, foreman, found that too much time was being wasted in first preparing the drill proper, and then in aligning and securing the door to the box table of the drill, besides having to repeat the procedure after one set of holes had been drilled.

In the present set-up the holes in the hinge lugs are drilled in one operation, and alignment of the water door is a matter of only a few minutes. Here the door is first placed upon the two carefully planed wooden blocks placed across the wings of the lathe saddle from which the cross slide has been removed, then aligned and rigidly secured to the lathe saddle by four steel clamps. Next, the drill is inserted into the chuck attached to the lathe spindle, and the saddle, with the door, is slowly advanced to the revolving drill. After the first set of lugs has been drilled, the saddle of the lathe is moved back, and the procedure is repeated after a drill extension with the original drill has been attached to the lathe spindle. By employing the method described, the drilling time can be cut by 50 per cent.



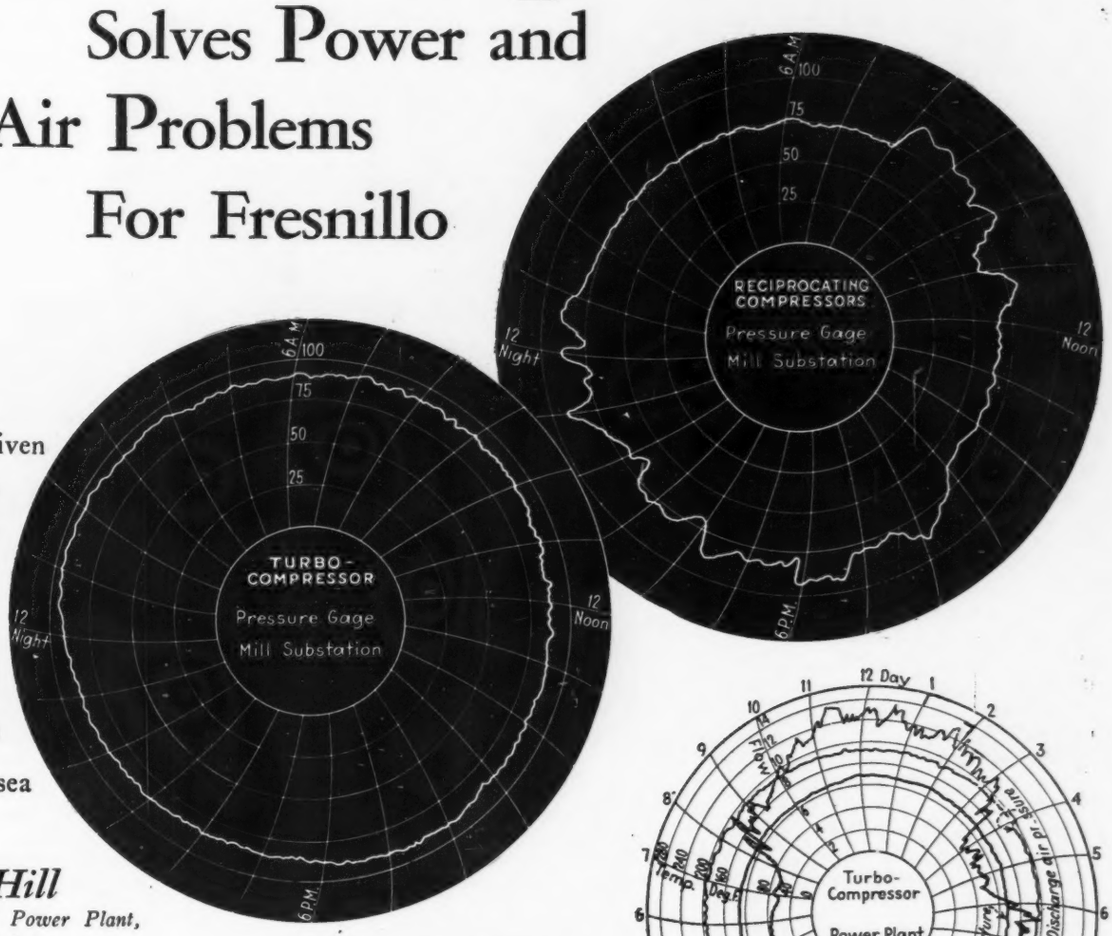
Turbo-Compressor

Solves Power and Mine-Air Problems For Fresnillo

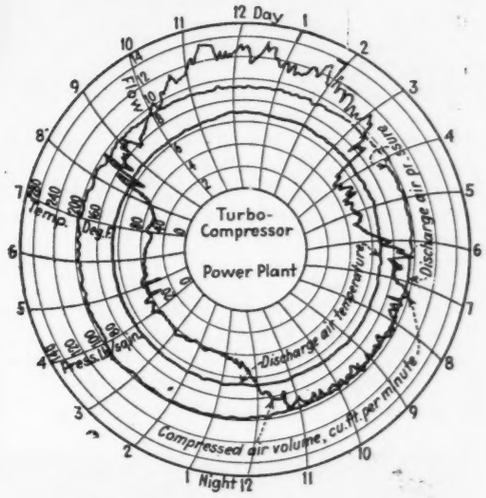
New steam-driven unit of 12,000 c.f.m. normal output now serving this Mexican company, at 7,300 ft. above the sea

James T. Hill

Superintendent of Power Plant, The Fresnillo Company, Fresnillo, Zac., Mexico



PRESSURE GAGE CHARTS for the turbo-compressor (left) and the reciprocating compressors (right at top). The latter shows the difficulty had with the reciprocating units when laboring under the demand for 90-lb. air for running rock drills. The left-hand chart shows the steadiness with which the turbo-compressor does this work



TURBO-COMPRESSOR PERFORMANCE is shown by the bottom chart. The very irregular line registers the volume of air compressed, in cubic feet per minute, throughout a 24-hour day. The outer of the two more uniformly circular lines drawn by the recording pens gives the pressure of the discharged air, and the inner line gives its temperature

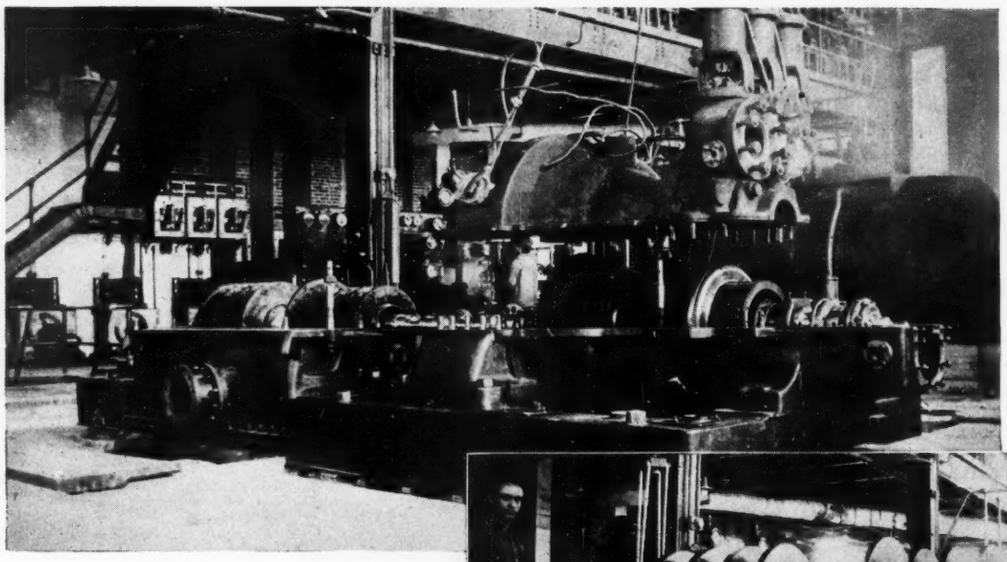
RECENTLY, a steam-turbine-driven centrifugal compressor was placed in service by the Fresnillo Company in its power plant at Fresnillo, in the State of Zacatecas, Mexico, where it will supply compressed air to the company's Fresnillo mine. At this plant, a maximum of 12,600 cu.ft. of free air per minute has heretofore been provided by means of steam- and synchronous - motor - driven reciprocating compressors, but for some time this equipment has been unequal to the task of maintaining the desired pressure of 90-lb. gage which is required for efficient rock-drill operation. Inasmuch as the 7,500-kva. turbo-generator which carries the station load was delivering its full rating during a large part of the day, it was out of the question to increase compressor capacity by installing additional electric motor-driven reciprocating equipment. A study of various methods of securing an increased air supply resulted in the decision to install a steam-turbine-driven centrifugal air compressor, inasmuch as by this method three objects would be attained. These were:

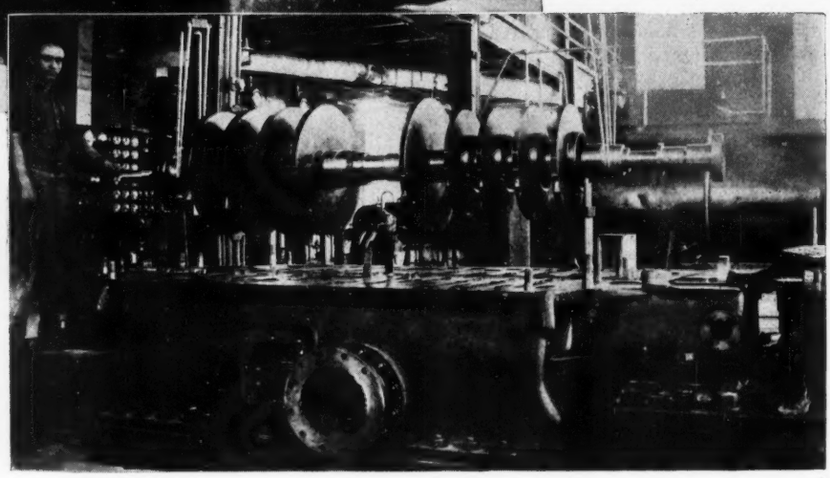
1. Release of 1,400 kva. of generator capacity for utilization on additional extensions.

2. Production of sufficient air volume to maintain the desired pressure of 90-lb. gage.

3. Production of compressed air at a reduced steam rate per unit volume of air, due to the higher efficiency of the turbo-compressor compared with that of motor- or steam-driven reciprocating equipment.

The turbo-compressor unit was designed and built by Brown-Boveri Corporation, Ltd., of Baden, Switzerland. The turbine is of the impulse-reaction type, having one impulse wheel and twenty-three sets of reaction blading, intended for steam at 200-lb. gage pressure and 575 deg. F. total temperature. Speed ranges from 6,500 to 7,650 r.p.m. with the emergency overspeed control set to trip at 7,725 revolutions. The turbine exhausts into an Alberger condenser, which forms a part of the standby equipment of the power plant.





ASSEMBLING THE TURBO-COMPRESSOR

Here (at the right end) is seen the impulse wheel and the 23 sets of reaction blading of the impulse-reaction steam turbine, and (at the left end) the air-compressing element in place. The illustration below shows the air-compressing element, consisting of nine impellers mounted on a three-bearing spindle, which is about to be set in position

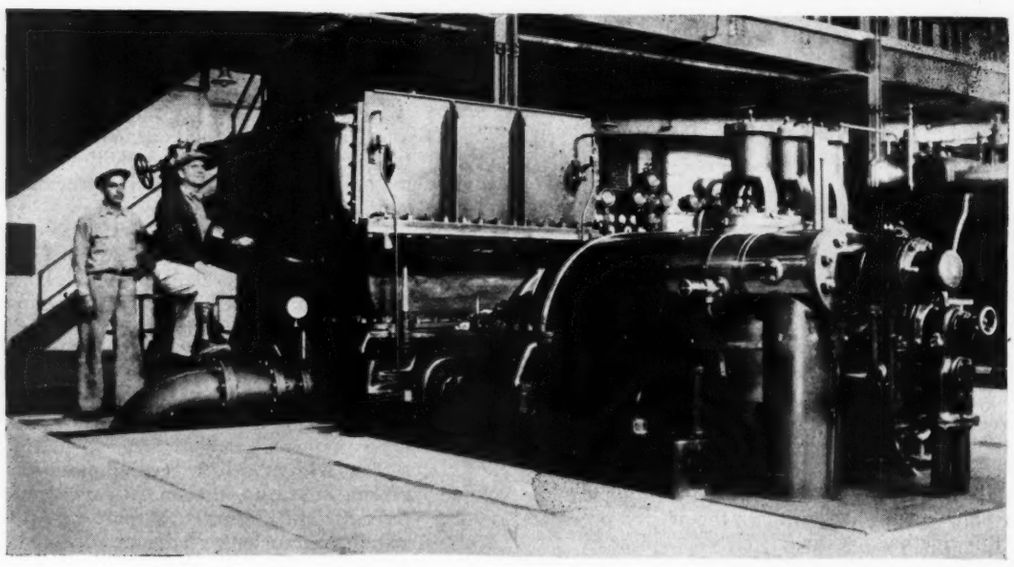
A vacuum having a back pressure of 2 in. of mercury is maintained on the turbine exhaust. Air and other non-condensable gases are evacuated from the condenser by an Ingersoll-Rand two-stage air ejector.

The centrifugal compressor is built in accordance with the manufacturer's latest design, for operation at 7,300 ft. above sea level, and is direct-coupled to the steam turbine. The air-compressing element consists of nine stages or impellers mounted on a three-bearing spindle, set in a horizontally split case similar to that of a multi-stage centrifugal pump.

During compression the air is very efficiently cooled by passing through seven parallel stages of finned tube nests, grouped in two sets of intercoolers, arranged horizontally, one above and one below the impeller element. The cooling-water flow through the intercoolers is 615 g.p.m. with a temperature rise of 10 to 15 deg. F.

Atmospheric temperature of the air entering the compressor ranges from 75 to 90 deg. F. The air is compressed to 95 lb. per square-inch gage, and is discharged at a temperature of 140 to 150 deg. F. A material increase in compressor efficiency results from the cooling of the air during compression, and, furthermore, as no lubricating oil is used in contact with the air, fire and explosion hazards are eliminated.

Normal volume output of the unit is 12,000 c.f.m. of free air, at which output the machine operates at its best efficiency. The set is capable of carrying a 20 per cent overload, representing an output of 14,400 cu.ft. per minute of air. Air pressure is automatically maintained at 95-lb. gage by means of speed control by the throttle governor. The compressor operates without pumping down to zero volume of air delivered. This is accomplished by a very simple



THE TURBO-COMPRESSOR INSTALLED

In two views at left and right respectively. The near end in each picture is the steam-turbine or driving end, and the far end is the air-compressing end. Other views presented elsewhere show the machine in course of being assembled

and reliable governor mechanism, which delivers excess air during light-load periods to an impulse wheel mounted on the end of the compressor spindle. This results in the recovery of energy and in the elimination of the annoying fluctuation in power input and in the speed, as well as the unpleasant noise in the plant due to the operation which characterizes several types of periodically working devices heretofore in use for preventing pumping.

Acceptance tests were made on the compressor unit at the factory and witnessed by Ernst Hinrichs, advisory engineer for the Fresnillo company. I have since checked at Fresnillo the results of these tests and found them to be in close agreement with the manufacturer's guarantees. The saving in steam with the new turbo-compressor varies with the air output, increasing as the load increases. On a comparative pressure-volume basis, it is of the order of 7,000 to 9,000 lb. per hour during high-load periods. Air volume, discharge air pressures, and discharge air temperatures are recorded by a graphic instrument installed at the centrifugal compressor in the power plant.

These centrifugal compressor units are also designed with a motor drive, and the correct speed is obtained by means of connecting gearing.

The weight of the turbo-compressor unit is 32 metric tons. Floor space occupied is 20 ft. 10 in. by 7 ft. 9 in., with a height of 7 ft. above floor level. Following is an interesting comparison of the weight in pounds per cubic foot of air per minute compressed as compared with motor-driven and steam-driven reciprocating machines.

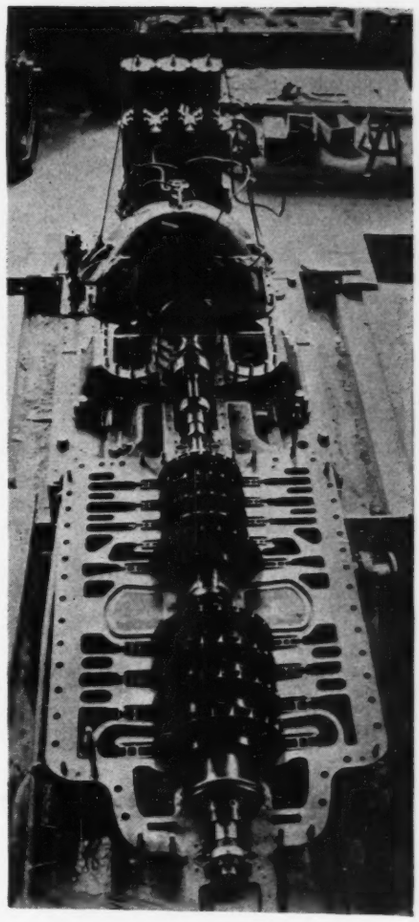
Turbo-compressor at 12,000 c.f.m., 6 lb. per c.f.m.

Turbo-compressor at 14,400 c.f.m., 5 lb. per c.f.m.

Motor-driven reciprocating 2,500 c.f.m., 17 lb. per c.f.m.

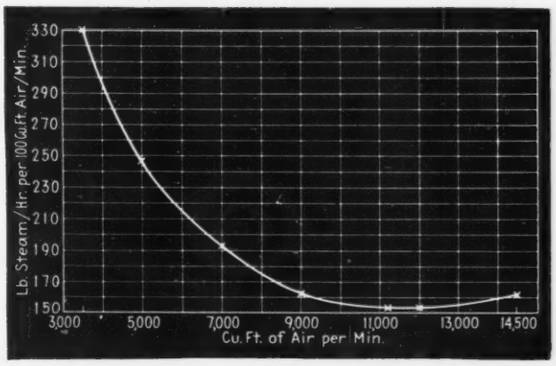
Steam-driven reciprocating 4,100 c.f.m., 23 lb. per c.f.m.

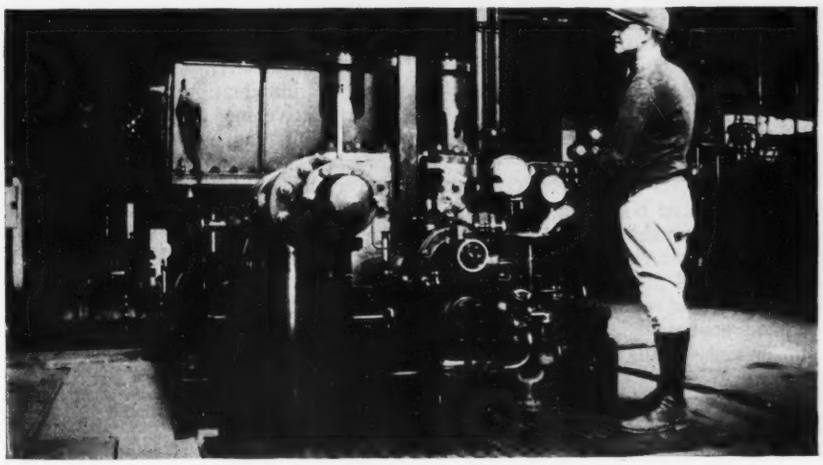
The foregoing data, with the views taken during the erection of the machine, show clearly the small size and compact arrangement of the turbo-compressor, making possible its installation in the power plant, with minor rearrangements of existing equipment. The turbo-compressor is attended by the regular operating force of the turbine plant, thus effecting a reduction of five attendants formerly required on the reciprocating machines. A considerable reduction in the quantity of lubricating oil consumed is a further source of economy resulting from its installation, not to mention decreased cost of upkeep for repairs and renewals.



THE IMPELLERS of the nine-stage air-compressing element and the spindle on which they are mounted are here seen in place from above. At the far end of the unit the driving turbine

CHARACTERISTIC CURVE of new turbo-compressor, June, 1936. The turbine is intended to take steam at 200-lb. gage pressure at 575 deg. F. temperature and exhausts against 2-lb. back pressure. The set can carry a 20 per cent overload, representing an output of 14,400 cu. ft. of free air per minute. Air is compressed at 95-lb. gage, efficiency being gained through intercooling

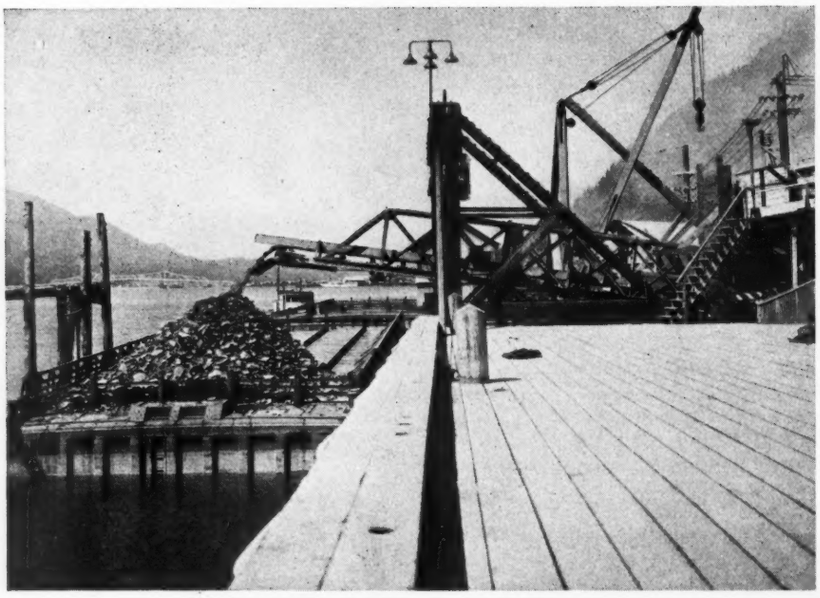




The new machine has been in satisfactory operation since April 23, 1936, running 24 hours per day and six days per week. During heavy load demand for air it has produced up to 15,000 c.f.m. for periods as long as one hour.

Turbine and compressor have come up to all expectations so far, and I feel that if the machine proves its reliability the centrifugal compressor will revolutionize compressed-air production in the mining industry in Mexico and the United States. It is believed that this is the first machine of this design and capacity installed at an altitude of 7,300 ft. in the western hemisphere.

Barges For Waste Disposal



1 WASTE DUMP DOCK, where large wooden barges measuring 101 ft. long and 34 ft. wide are loaded with mine rock. The conveyor is almost horizontal as the first rocks fall onto the barge, and is raised as the height of the pile increases. Three barges are used for continuous operation

Alaska Juneau adopts this scheme when more usual means prove inconvenient. . . . Self-dumping boats deliver coarse rock to Gastineau Channel's depths

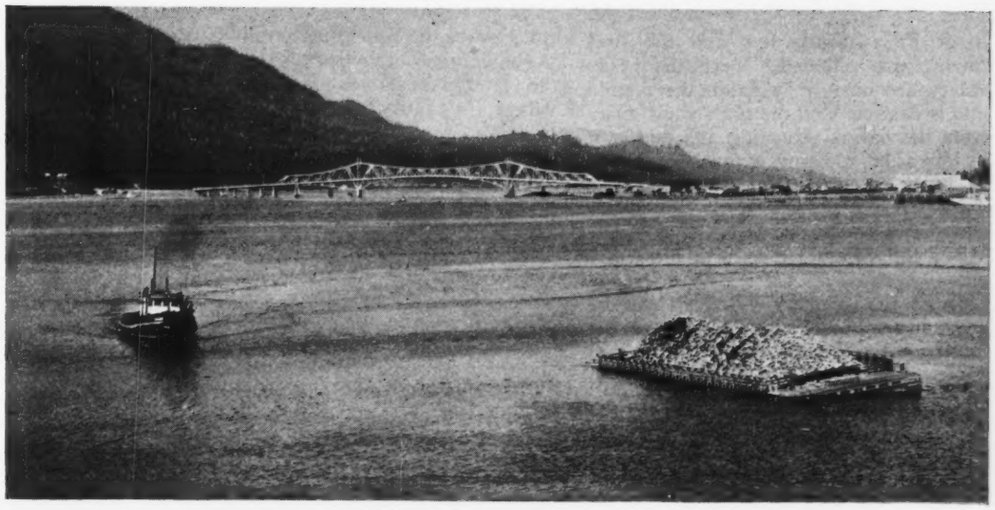
2 MINE ROCK RIDING out to the deep part of Gastineau Channel. Along the dock can be seen the two other barges of similar design and construction. Cars loaded with waste come down the incline that skirts the foot of the mill and unload into a bin at the right of the photograph. From here, conveyors carry the rock to the adjustable loading conveyor, which is within the upright wooden framework supporting the three pulleys, seen on the dock

ONE of the most interesting operations at the property of Alaska Juneau Gold Mining Company at Juneau, Alaska, is the novel method of disposing of coarse waste by specially built wooden barges. Previous to this installation, and from the time sorting of ore was begun in 1920 until 1931, coarse waste was sent to Gastineau Channel by gravity tramming to a bin on the shore and thence by conveyor belt to stackers on the edge of the advancing waste pile.

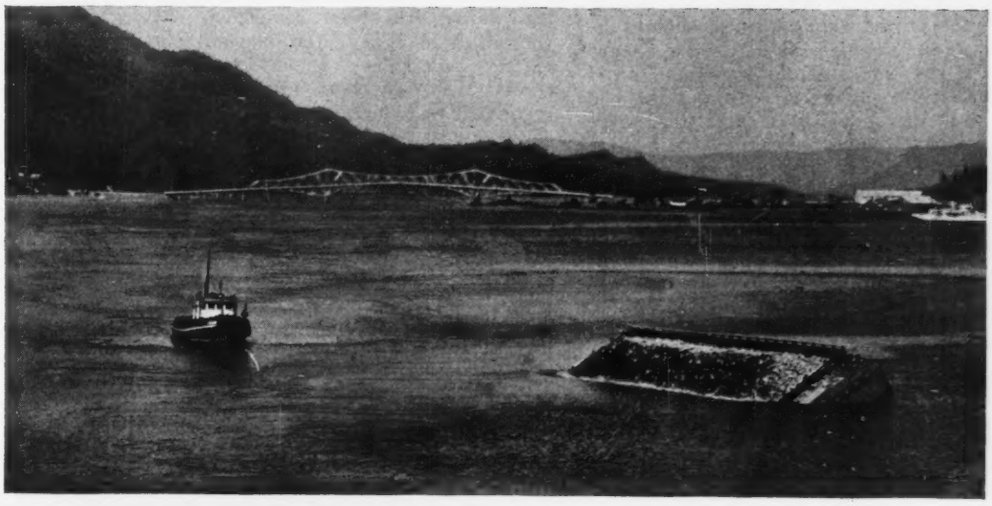
In 1931, when the limit of the single conveyor, with its attendant stacker belts, was seen to be approaching, 2,000 ft. of trestle was built at the lower end of the gravity tramway. Since the slope from the storage bin at the mill to the waste dump was not sufficient to handle the material further by gravity, a 9-ton trolley locomotive was added to the system. This construction added materially to the cost of waste disposal for the year 1931, and since from time to time more of such additions would be required, with attendant capital outlay, together with increasing operating costs, investigations into other methods of waste disposal were begun by the management.

Raising the level at which waste was being dumped and tramming altogether by trolley was considered, but since this would mean a material construction cost for a tunnel and an appropriate trestle, the rebuilding of public roads, flumes, and other appurtenances, coupled with the uncertainty of the action of a higher waste pile, with its accompanying weight, attention was directed to the disposal of waste into the deep waters of the Gastineau Channel by barge. Accordingly, a naval architect was consulted and much information was gathered as to the relative merits of hopper barges and various types of self-dumping barges. The advantages of steel and wood construction were also carefully investigated. After considering all the information available, it was decided to build self-dumping wooden barges, each of 600 tons' capacity, designed after the Vincent patents, and a suitable tugboat to handle the barges.

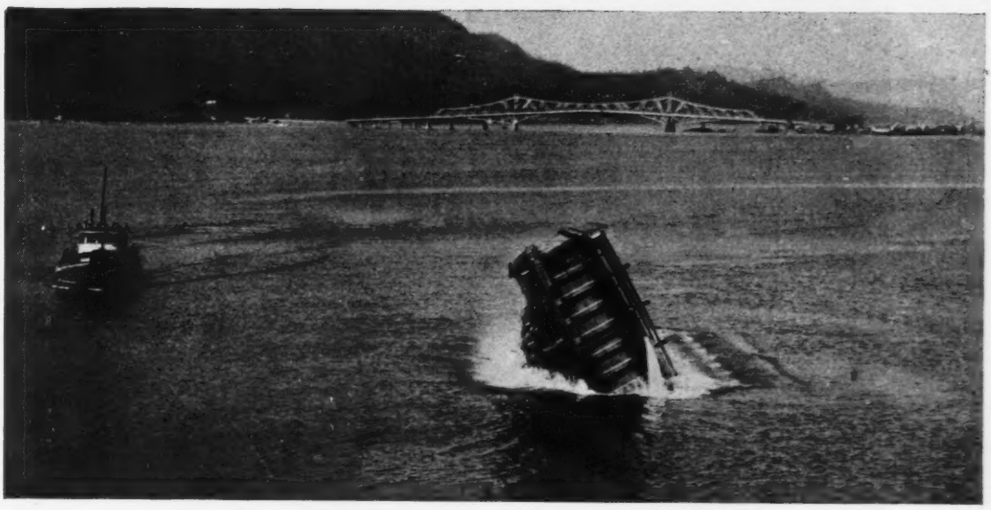
Late in 1934 the contracts for three self-dumping barges and a 72-ft. tugboat powered by a 275-hp. full diesel engine were let. The tug registers 63.33 gross tons, 43 net tons, 67.8 ft. length, 17.65 ft.



3 FIRST STAGE OF DUMPING. This is started by opening 14-in. valves, which permits water to enter a compartment from underneath, the air escaping through a valve above deck. Two minutes are required thus to change the center of gravity and cause the barge to list



4 LISTING CONTINUES and as the load moves, the action is accelerated and the 600 tons of rock drop into the channel in a specially designated area approved by the War Department of the United States Government



5 OVER SHE GOES, only to show her bottom, which now becomes her top. The submerged compartments are almost filled with water and in this position can be seen emptying themselves sufficiently (note stream of water on right side) to maintain necessary balance. The barge now returns for another load

breadth, and 9.95 ft. depth. The boat equipment includes a towing winch and a 6-in. centrifugal scow pump, both driven by clutch from the main engine; and an anchor winch driven by air from the compressed-air starting system. The scow pump is for pumping out a scow in the event of a defective valve or the barge failing to dump its load by being underloaded. The pump discharge line is fitted with a valve and a monitor mounted on the engine-room roof to provide fire protection along the water front.

The dimensions of the barges are as follows: Length, 101 ft.; beam, 34 ft.; and depth from deck to deck, 10 ft. These barges are double sided; in other words, both top and bottom are decks and have stanchions to hold a load of rock. Four compartments run the entire length of the barge, of which two are air compartments and two water compartments. Dumping of the barges is controlled by valves. At the loading station each barge is filled by a flexible conveyor and then towed by the tug to the point where the load is to be dumped. When this point is reached, the towing cable is reeled in by the towing winch until the tug has been attached to the

barge by a manila line and the steel towing line removed. Next, the 14-in. valves are opened by hand, the manila line is cast off, and the tug steams away from the barge, returning and taking it in tow after dumping is finished.

On each valve stem there are two valves, one on the deck below water and the other on the deck above water. When the valves are opened, the water enters into the water compartment through the submerged valve, and the air is liberated through the valve on the upper deck. Though there is a set of valves at each end of the barge for each water compartment, only one set is used for dumping. An interval of about two minutes is required to put enough water into the water compartment to change the center of gravity and thus force the barge to list. When this occurs, the water in the compartment rushes to the side and the load begins to slide toward the low side. Listing continues and is accelerated by the movement of the load until the momentum turns the barge completely over, dumping its 600-ton load of rock. The complete dumping cycle requires only 3½ min.

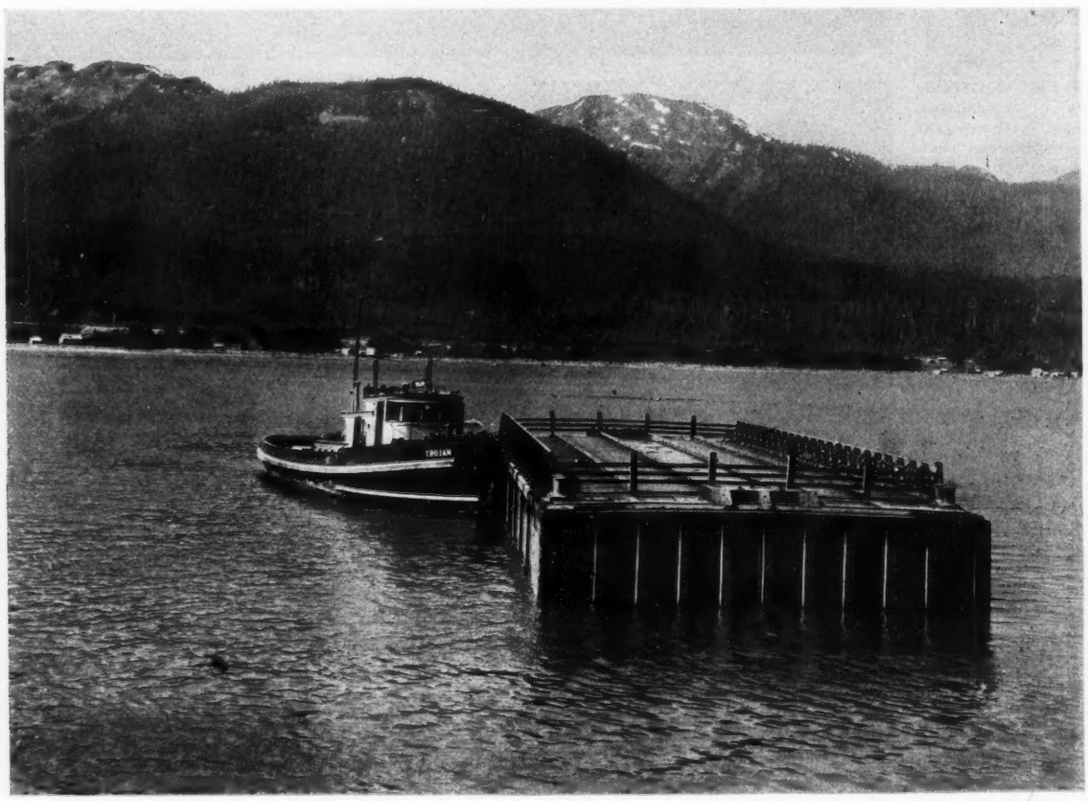
When the barge has turned over, the valve that permitted the air to escape from the water compartment becomes automatically the water valve through which water from the water compartment is discharged. After the barge has been dumped, the water compartment rides above the water line on the outside of the barge, thereby letting the water in the water compartment drain out. These valves are again closed before the barge is reloaded. Thus, when the barge is brought to the loading station, the waste material is loaded upon the deck that was previously the bottom of the barge. For continuous operation three barges are provided, one for loading, the second for towing, and the third for repair. The barges are of sturdy construction and require little repair work.

Both tug and barges were designed and their construction was supervised by H. C. Hanson, naval architect, Seattle, Wash., and all units were built by the Winslow Marine Railway & Shipbuilding Company, of Winslow, Wash. They were delivered at Juneau during the summer of 1935 after a wharf and loading station had been completed. At Juneau there is a variation of about 25 ft. in the tides. It was therefore necessary to provide an adjustable conveyor belt to reduce wear on the decks of the barges to a minimum.

Dumping into Gastineau Channel, both along the shore and in the deep waters, is by permission from the War Department of the United States Government. That part of the channel covering the permit to dump in the deep waters held by Alaska Juneau Gold Mining Company has been charted and marked off into blocks or sections. The crew of the tugboat make a daily report showing in which section each barge load has been dumped. This enables the engineering department to determine the exact amount of waste dumped in each section. The approximate amount of waste that each section will hold being known, dumping can be so regulated that the water will not be made too shallow for navigation. Soundings are made at frequent intervals to check the records.

When the aforedescribed system of handling waste was adopted, it was not expected that it would greatly decrease the cost obtained with previous methods; rather it was hoped that costs would be kept from rising and that they might be stabilized at the prevailing figure for several years. Indications are that this will be attained. The method has now been in use for more than ten months. During that time there has been some extremely cold and stormy weather. The only delay experienced from weather conditions was when the water was so rough as to make it impossible for a man to go from the tug to the barge to open the valve. From present indications the barges will last for several years, and their cost can be charged off against the large amount of material handled.

ITS LOAD DISCHARGED, the barge is now being picked up again by the tugboat to be towed back to the loading dock from which it recently came. What was its bottom until a few minutes ago has now become its deck.



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Nickel Companies
Prepare for Bigger Business

NEVER in its long history has the Sudbury nickel-copper district of northern Ontario witnessed greater activity than at present. No boom prevails. Rather, what one sees is in the main the first and immediate effect of the increase that has been taking place in the consumption of nickel as industry has learned that the metal's peace-time applications rival and surpass its uses for the war purposes which once afforded its principal market. Today the producing companies number two, one of these the International Nickel Company of Canada, now larger than ever, and the much smaller Falconbridge Nickel Mines, Ltd., whose mine and plant are situated 14 miles northeast of Sudbury, the enterprise being already soundly established after a short six years.

International Nickel is operating its flotation plant and smelter at Copper Cliff, the smelter at Coniston, formerly run by the Mond company, and the Frood and Creighton mines, these two of its several mines more than sufficing to meet its ore requirements. A mile south of the smelter at Copper Cliff is the plant of the Ontario Refining Company, established a few years ago as a result of the increase in the copper resources in the nickel-copper ores of the district and now owned completely by International Nickel. Still nearer to the smelter is the sulphuric acid plant of Canadian Industries, Ltd., which uses the smelter's converter gases as its raw material. Establishment of these two plants within the district, one to turn out in refined form and in the usual, and some unusual, commercial shapes the copper produced, and the other to utilize an otherwise wasted product, has had a share in increasing the local activity and prosperity.

Any effort to describe the company's mines or plants in detail would be superfluous, an entire issue of the *E.&M.J.*, that of Nov. 10, 1930, having been devoted to the "Inco" enterprise, as many readers will remember. Nevertheless, in the period of almost six years since elapsed, changes of one sort or other have been made and some of them are dealt with briefly in these notes.

INTERNATIONAL NICKEL

Shows the Visitor:

New shafts and hoists . . . An improved mining method . . . A larger smelter . . . Electric furnaces for melting copper . . . A hot-metal car for transporting molten blister

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AT FALCONBRIDGE

One Finds:

A new shaft and plant . . . Better preparation of ore for concentration . . . More smelting capacity . . . Metallurgical practice adapted to conditions

A. H. Hubbell
Associate Editor

During the year to date, operations at the two operating mines and at the mill and the two smelters of International Nickel have proceeded at a substantially better rate than in 1935, when, according to the company's recent annual report, 3,382,409 tons of nickel-copper ore was mined and shipped to the plants, the Frood mine supplying 2,875,599 tons of this and the Creighton mine the remainder. Of this total, the concentrator, at Copper Cliff, treated 2,584,666 tons, all of the concentrate being smelted in the reverberatories of the Copper Cliff smelter. The tonnage not concentrated was smelted direct in the blast furnaces at Coniston. Copper Cliff has no blast furnaces, save one which is used for Frood magnetically separated ore and smelter reverts. The tonnage reported as milled was the largest that the concentrator has ever handled since its erection in 1930, the daily milling rate having been increased to 8,000 tons during the year covered by the report.

At the beginning of 1936, the Frood mine, which a few years ago was developed to only a relatively small extent, had been opened to the point of having over 34.5 miles of development work, with 103 stopes and 16 pillar stopes, these having respective daily capacities of 125 and 55 tons each. Material advance was likewise made last year in development work in the Creighton mine, a total of 9,200 ft. being added.

In keeping with the mine-development program, additions are now being made to both the concentrator and smelter at Copper Cliff, whereby the capacity of each will be increased by approximately one-third. When this work is completed, probably before the end of 1936, the mill will be able to handle 11,000 tons of ore per day and the smelter the resulting concentrates. Concentration proceeds as before, broadly speaking, with such improvements as circumstances have called for and an able management has found it possible to devise.

The smelter at Copper Cliff has 30 Herreshoff roasters, five 110x24 ft. (inside dimensions) reverberatories, and twelve 13x35 ft. (inside dimensions) Peirce-Smith converters. Of the roasters, twelve are idle, the copper concentrates made by selective flotation not being roasted, as intended when the roasters were provided. The copper concentrates are smelted in two reverberatories and the matte made is blown to blister in four converters. The eighteen roasters now operating handle the nickel-copper concentrates produced by the mill. The calcine they produce goes to three reverberatories, six roasters supplying one reverberatory, and the nickel-copper matte made is blown up in four of the converters to 77 per cent grade and delivered to the Orford plant for the separation of the two

COPPER CLIFF SMELTER of International Nickel Company. Hidden by the smoke from the nearer of the two stacks, the work of building a third one is under way. In the foreground is the general office. In the background is the concentrator. Photo by Canadian Airmaps, Ltd.

metals. When the construction work now under way is finished, the smelter will have nineteen converters. Seven of these will blow copper matte, which will be produced by two reverberatories. The resulting blister, which at present is poled in a holding furnace and then cast in 500-lb. slabs for the refinery, will be sent molten to the mile-distant refinery in a well-insulated hot-metal car of 75 tons' capacity, one of that type being now successfully in operation. Three more are being ordered.

Construction of a new concrete stack lined with firebrick was begun on April 8 last and is expected to be finished by Sept. 15. The smelter will then have three large stacks in service. Completed, the new one is 550 ft. high over all and 500 ft. above the foundation. Diameter at the bottom is 62 ft. 1 in. outside and 55 ft. 9 in. inside; at the top, it is 44 ft. outside and 40 ft. inside.

By far the larger part of the total ore hoisted at the Frood and Creighton mines comes from the former. With a total underground force of 2,100 to 2,200 per day and some 400 additional men, including those on the surface and the bosses, the Frood is hoisting approximately 10,500 tons per day of two 8-hour shifts. All of this tonnage is milled save some coarse magnetic ore, which is smelted in the blast furnaces at Coniston and Copper Cliff. Creighton's tonnage comes entirely from its No. 3 (inclined) shaft at present. It now amounts to 2,700 tons per day, this having risen from 1,800 within the past year. A new shaft, No. 5, is being sunk at Creighton, and the ore to be hoisted from it will supply the new addition to the smelter. The nickel-copper ratio in Creighton ore is approximately 2:1, the reverse of the ratio of the two metals in the Frood ore.

Development and general underground layout of the Frood mine were described with illustrations in *E.&M.J.* of Nov. 10, 1930, as already stated. Naturally, modifications of practice have been made in the intervening time. The mine is opened for a distance of approximately 3,000 ft. along the strike, with a block of practically undeveloped ground about 1,000 ft. long in the center, so that the workings are in effect divided into two sections along the strike, one north and one south. Of the two operating shafts, put down from the surface, the 3,045-ft. six-compartment vertical No. 3 shaft is opposite the south area and the 3,603-ft. three-compartment vertical No. 4 shaft opposite the north area. The two are connected by a footwall drift. A third shaft, 10x14 ft. in inside dimensions and lined smoothly with concrete and inclined 77 deg. down to the 1,200 level and 61 deg. from there to where it bottoms at the 3,100 level, is used for ventilation. Its inclined depth is 3,388 ft.

Levels originally opened were the 2,200, 2,400, 2,600, and 2,800. To provide a definite upper limit for the two blocks of ground, north and south, being mined according to a schedule, the 2,400-level stopes were stopped 48 ft. below the 2,200 level and the ground above has been left untouched.

Stoping until recently was done by square-set and cut-and-fill methods. Stopes were started 30 ft. above the level rail and were carried 45 ft. wide from footwall to hanging wall with 35-ft. pillars between. The width of the ore between walls averages 125 to 150 ft., varying from 60 to 275 ft. Stopes are superimposed vertically over each other, as are also the pillars. Square sets are 5½x5½x7-ft. standard.

Beginning in 1933 a change was made. Stopes since then have been started 7 ft. above the rail base, allowing just enough space above the rail base to permit subsequent filling and hauling operations. Stopes are now supposed to be 27½ ft. wide, with a 16½-ft. pillar. Actually, they are 30 ft. wide and the pillars 15 ft., due to overbreakage. They are laid out in blocks of ten, as a structural unit, and at the end of each block a temporary rib is left, having a width equal to the combined width of a stope and two pillars, through which the crosscuts connecting the main footwall drift and the parallel longitudinal drifts in the ore are driven. Chutes are placed in the center of stopes (5-set stopes) in the center line of sets, 22 ft. apart running from wall to wall.

By making this change, the percentage of ore to be mined by regular stoping has been increased and that to be mined by pillar stoping has been decreased. Moreover, the cost of horizontal pillar mining has been lessened by eliminating the 30-ft. height to be mined horizontally. It has been found that the three-set pillars can be mined as a whole. This is a general practice. In areas of heavy ground they are sectionalized. These sections are mined from three to six sets in length, taking the full width of the pillar. A great deal of support to the pillars is obtained from the stope fill.

In the "long-girt" stoping adopted, the two sets on either side of the center line of sets in a stope are replaced by long-girt sets. The girts in these sets extend the length of two sets across the stope. At its inner end each long girt rests on the nearest post of the center set and at its outer end on a single row of similar posts with regular caps between. Thus in a stope, from side to side, one has only four rows of posts, running from foot to hanging, two rows being in the center, 5½ ft. center to center, and one row on each side 11 ft. center to center from the nearest row of center posts. Two-inch cedar plank, 6 to 10 in. wide and 11 ft. long are nailed to the stope side of the two outside rows of posts to form the gob fence. The individual planks are staggered lengthwise from set to set, so that no two adjacent ends are flush. The timber used is native jack pine and spruce. For the girts, 10- to 12-in. round timber is slabbed off on two sides to 8-in. thickness, with a 6x6-in. horn.

Plank slides are built adjacent to the four sides of each chute set diagonally from the mining floor down to the set below, so as to form a four-sided funnel at the top of each chute to minimize mucking. These slides are moved up one set at a time as a new mining floor is established, just before the floor below is filled. This keeps the fill from running into the chutes. Just before a floor is filled, the girt on either side at the floor level is pulled out, and thus the amount of timber left in the fill is reduced. The saving as compared with leaving five square-sets embedded in the fill, as previously, is appreciable.

Compared with square-setting, long-girt stoping provides an adequate fire-break through timbered areas from level to level. The desire to secure this was the principal incentive for making the change. The cost, moreover, is less than that of standard square-setting.

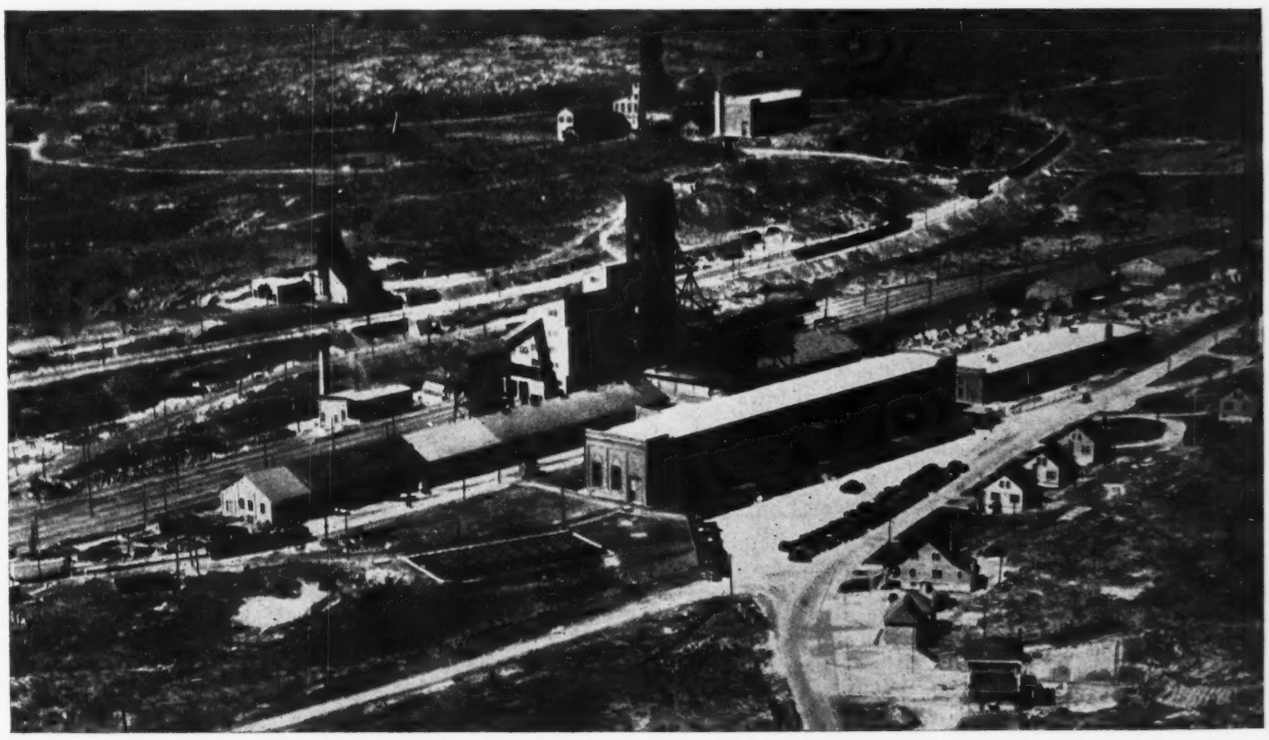
In addition to the three shafts mentioned, the Frood has another, known as No. 6, which has been sunk from the 2,800 level to serve the territory below that level, with respect to men and supplies. It has two cage compartments, 14 ft. 3 in. by 5 ft. 10 in. each, inside the steel sets, an airway 6 ft. 8 in. square, and a ladderway. It is timbered with steel sets and served by a double-drum single-reduction-geared Canadian Ingersoll-Rand hoist. This is driven by a 600-hp. a.c. motor and is equipped with post brakes and a multiple-tooth positive-type clutch. The brakes are set by gravity. Both brakes and the clutch are controlled by the hoistman, through the operating levers, by means of the brake and clutch engines, which are operated by oil under pressure. The brake and clutch are interlocked so that the clutch cannot be moved unless the brake is set, and vice versa. It is also equipped with Model D Lilly controllers with man safety attachments. The conditions under which it operates are given in Table I. The 2,800-level hoist room is lofty in height and striking in appearance.

To supplement the No. 3 55-deg. incline shaft at Creighton mine, a new shaft, No. 5, was started on Jan. 2, 1935, as previously referred to, and by the time these notes were taken, on the last day of May of this year, had reached a depth of 3,600 ft., with 600 ft. more to go. This shaft is vertical and is 28 ft. 5¾ in. by 15 ft. 11¾ in. in dimensions outside the timbers, the rock excavation being 30x18 ft. Sinking proceeded continuously except for the interruptions caused by opening stations and placing bearers and concrete. The full section was drilled and blasted down to a depth of 1,038 ft. From here down to 2,625-ft. depth, the work was done by completing and reaming out to the shaft dimensions a series of raises driven from the levels in the 1,587-ft. interval. Below the depth of 2,625 ft. sinking was resumed with the full 30x18-ft. shaft section. Sinking has been done with a double-drum geared Nordberg hoist driven by a 650-hp. 550-volt G.E. induction motor. At the 2,625-ft. level the shaft is 550 ft. from the ore body; at the bottom level it will be 1,500 ft. away. From the 2,625-ft. point down, the level interval is 200 ft., it being less above this elevation. A crusher and a loading pocket will be installed below the bottom level, with an ore pass connecting this point with the 2,625-ft. level.

No. 5 shaft will have a rock house capable of handling 5,000 tons of ore per day, 130-ft. steel headframe and a new brick-and-steel hoist house 224x80x63 ft. in dimensions with a 44x60-ft. addition to house the transformers. In this building will be two hoists, that for the skips being of Canadian Allis-Chalmers make and having two cylindrical-conical drums, of 25- and 12-ft. diameters. This is said to be the largest hoist in Canada. The cage hoist is of Nordberg design. Data covering these hoists are:

The skip hoist is a bi-cylindro-conical, double-drum, single-reduction-geared electric hoist with drums arranged in tandem, manufactured by Canadian Allis-Chalmers, Ltd. It is driven by two d.c. motors, 1,200 hp. each, made by the General Electric Company of England. The hoist is equipped with parallel-motion brakes and multiple-tooth positive clutch. Brakes are set by gravity. Both brakes and the clutch are controlled by the hoistman through the operating levers by means of hydraulic brake and clutch cylinders. Oil under pressure is supplied to the brake

THE FROOD MINE from the air. Famous for the part it played in 1928-29, this mine also is outstanding for the spick-and-span appearance it presents underground and on the surface. In the foreground is No. 3 shaft, and behind this and to the left is No. 1 shaft, which serves for ventilation only. In the distance is No. 4 shaft. Photo by Canadian Airmaps, Ltd.



and clutch cylinders by an automatic pressure system. The brake- and clutch-operating gear is interlocked so that the clutch cannot be moved unless the brake is set. This hoist also has Model C Lilly controllers. Conditions under which it operates are given in Table II.

The Nordberg cage hoist is a double-drum, single-reduction-geared, electric hoist, built by John Bertram & Sons Company, Ltd. It is driven by a 1,200-hp., d.c. motor, made by the General Electric Company of England. The description of its brakes and clutch reads the same as that given for the skip hoist. The conditions under which it operates are set forth in Table III.

Both hoists will set 260 ft. back from the shaft center. They will take $1\frac{3}{4}$-in. rope, this passing over a 14-ft. sheave.

Main hoisting ropes used at the Frood and Creighton mines are of "special improved" plow steel for diameters of $\frac{7}{8}$-, 1-, $1\frac{1}{8}$-, and $1\frac{1}{4}$-in., and of "extra special improved" plow steel for $1\frac{3}{4}$-in. diameter. The breaking strength of the first-mentioned steel is 246,000-268,000 lb. per square inch; that of the latter is 257,000-280,000 lb.

Nickel steel is being used in place of ordinary steel for building skips, giving greater capacity for the same weight on the rope. Skips now used at the Creighton mine have 165-cu.ft. capacity, compared with 135-cu.ft. for the skips previously used, made of ordinary steel. In both cases the total load is unchanged.

All operations at both the Frood and the Creighton are standardized so far as possible. Time studies have been made of every operation and rates established accordingly. Every individual working place is covered by a separate contract, this providing a bonus in which all the men participate in proportion to the number of shifts worked, regardless of rates of pay. The rock has been graded. Rate of drilling and type of ground are two factors that determine the breaking allowance.

A school of instruction, in which shoveling, drilling, and timbering as well as safety in general are taught, is maintained in a stope on one of the levels in the mine. Men new to the work which they are to do are first given two weeks' instruction here and are advanced to the more skilled work as they show proficiency and the opportunity permits. The stope school is in charge of a foreman with a drilling instructor, a timbering instructor, and a mucking instructor on each of the two shifts the school is operated.

A description, in detail, of the electrolytic copper refinery of the Ontario Refining Company at Copper Cliff was presented by the plant manager, Frederic Benard, at the annual meeting of the A.I.M.E. in New York in February, 1934. Since then certain changes have been made and others are planned. The most interesting of these, which is now in process, is the undertaking to melt and cast copper from two 30-ton electric-arc furnaces, made by Canadian Lectromelt in Canada. The electric furnace has never before been used for melting tough pitch copper, although some units as large in capacity as 11 tons have been used in melting and casting steel. The management considers this installation the most progressive step forward in the copper business in many years. Operation of the furnaces will be continuous. A 30-ton bath will be maintained in each by charging cathodes at the same rate as the casting proceeds—approximately 10 tons per hour, 24 hours per day and 7 days per week. One of these furnaces will be used for making vertical castings, such as billets, vertical-cast wirebars, and long cakes. The other will be used in casting horizontal bars, ingot bars, and short vertical cakes. The management expects that the furnaces will require but little repairs. They will have sintered bottoms, which can be patched easily. To change roofs, the old one will be ripped off with a crane and a new one put on. An adjunct to each furnace will be a 4,000-kva transformer supplied by a 30,000-volt line. Each furnace will have three 18-in. graphite electrodes, the largest ever made in the plant of the Canadian Union Carbide Company at Welland.

Another interesting innovation in the copper industry is the recent installation of a hot-metal car having a capacity of 75 tons of metal for transferring molten blister from the converters at the smelter directly to the refinery—a haul of $1\frac{1}{2}$ miles. The car itself weighs 200 tons and has two four-wheel trucks at each end. These have roller bearings, thereby escaping, it is anticipated, the only trouble experienced with the otherwise similar but larger car used by the American Rolling Mill Company between its blast furnaces at Hamilton, Ohio, and its open hearths at Middletown. In this case, one should take note, the distance over which the hot steel is transferred is much greater than that at Copper Cliff.

The new car is made by the Treadwell Engineering Company. Unlike the older car, however, it is to be well insulated to prevent loss of heat. Sil-o-cel cement will be used next to the shell to cover the rivet heads. On this $4\frac{1}{2}$ in. of clay brick will be laid in the bottom half and $4\frac{1}{2}$ in. of insulating brick in the upper half, and then a complete ring of $4\frac{1}{2}$ in. of clay, over which will be laid a 9-in. thickness of Ritex chemically bonded magnesite brick. Total thickness of insulation will be 18 in.

A plant for recovering selenium and tellurium was added to the refinery in 1935. (The refinery has produced selenium in limited quantity from the start.) The process used is the same as that employed at the refinery of the American Metal Company's subsidiary at Carteret, N. J., a license having been obtained from the latter. The new plant is turning out monthly 10,000 lb. of selenium and 1,500 lb. of tellurium, although its capacity is greater than this. Also, a plant for producing single and double nickel salts has been added to the refinery's acid recovery section; likewise a Cottrell plant to the silver refinery. Previously the gases were sent through a scrubber.

Table I—Operating Conditions of Underground Hoist

No. 6 Shaft, Frood Mine

Hoisting in balance
Shaft, vertical.
Diameter of drums, 12 ft.
Face of drums grooved for 1¾-in. dia. rope, 4 ft. 8 in.
Capacity of drum, in two layers of rope, 2,300 ft.
Diameter of head sheaves, 12 ft.
Size of rope, 1¾ in.
Maximum allowable hoisting speed, 1,000 ft. per min.
R.p.m. of drums, 26.6.
R.p.m. of motor, 368.
Gear ratio, 13.8 to 1.
Time required for brakes to set after the emergency has been tripped, 4 4/5 sec.
Safe travel above surface, 78 ft.
Safe travel below 3,400-ft. level, 21 ft.
Weight of empty cage and chains, 13,100 lb.
Maximum allowable load in cage:
A—Handling men, 54 men.
B—Handling material, 13,000 lb.

Table II—Operating Conditions of New Skip Hoist

No. 5 Shaft, Creighton Mine

Hoisting in balance
Shaft, vertical.
Small diameter of drums, 12 ft.
Large diameter of drums, 25 ft.
Face of drums, grooved for 1¾-in. dia. rope, 13 ft. 4 in.
Capacity of drum, one layer of rope, 4,513 ft.
Diameter of head sheaves, 14 ft.
Size of rope, 1¾ in.
Maximum allowable hoisting speed, 3,000 ft. per min.
R.p.m. of drums, 38.2.
R.p.m. of motors, 400.
Gear ratio, 10.65 to 1.
Safe travel of skip above dumping position, 19 ft.
Weight of empty skip, 10,100 lb.
Weight of ore, 18,000 lb.

Table III—Operating Conditions of New Cage Hoist

No. 5 Shaft, Creighton Mine

Hoisting in balance
Shaft, vertical.
Diameter of drums, 14 ft.
Face of drums grooved for 1¾-in. dia. rope, 8 ft.
Capacity of drum, two layers of rope, 4,532 ft.
Diameter of head sheaves, 14 ft.
Size of rope, 1¾ in.
Maximum allowable hoisting speed, 1,500 ft. per min.
R.p.m. of drums, 33¾.
R.p.m. of motor, 400.
Gear ratio, 11.8 to 1.
Safe travel above surface:
Hoisting men, 54 ft.
Handling guides under cage, 12 ft.
Weight of empty cage and chains, 13,100 lb.
Maximum allowable load in cage:
A—Handling men, 54 men, 8,640 lb.
B—Handling material, 13,000 lb.

THE ELECTROLYTIC COPPER REFINERY of the Ontario Refining Company, one mile from the International Nickel smelter at Copper Cliff. Blister is now being transported molten from the converters at the latter plant to the anode furnaces at the refinery. Photo by Canadian Airmaps Ltd.

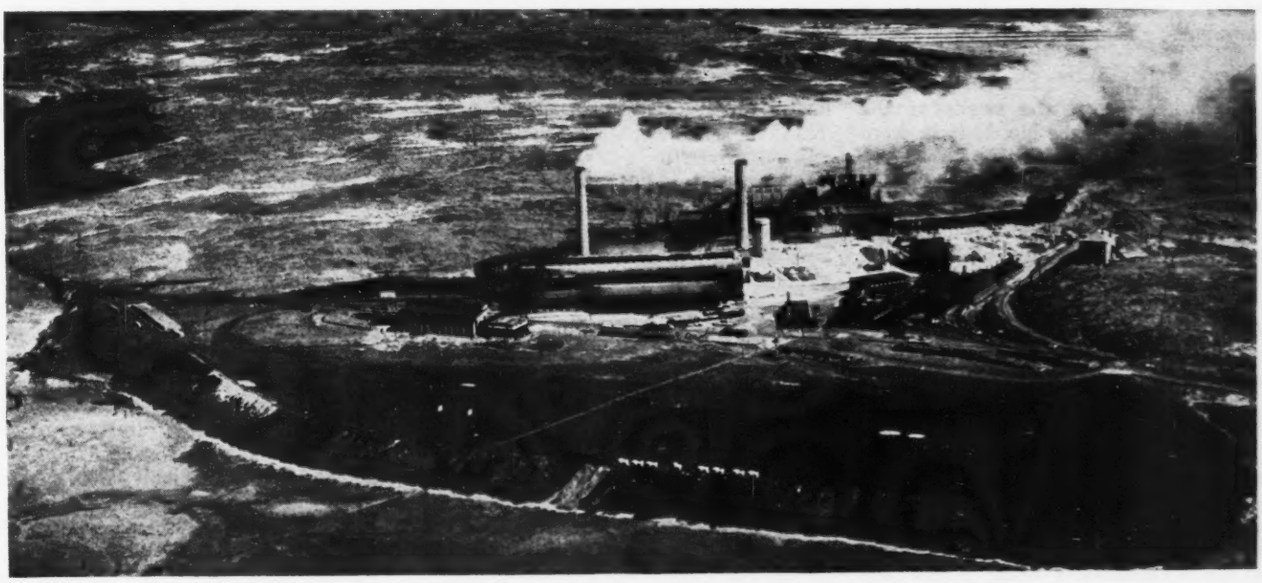
At present the refinery is employing 725 men, about 50 of whom are engaged in various new construction jobs.

In the operation of its several major units that have been mentioned the International Nickel Company is employing a total of 8,500 men in the Sudbury district. Of these, 700 are on construction. At the Frood mine 2,800 men are at work and 1,000 at the Creighton mine. This large and highly efficient organization is directed by Donald MacAskill, vice-president and general manager. Under Mr. MacAskill are the following: R. L. Beattie, and E. A. Collins, assistants to the vice-president; R. D. Parker, general superintendent; H. J. Mutz, general superintendent of mines; P. F. McDonald, general superintendent of smelters; W. T. MacDonald, concentrator superintendent; and Frederic Benard, refinery superintendent. R. M. Coleman is superintendent of the Copper Cliff smelter and W. A. MacDonnell of the Coniston smelter. F. J. Eager is superintendent of the Frood mine, and S. J. Kidder of the Creighton mine. J. F. Robertson is chief metallurgist, L. M. Sheridan, chief mechanical engineer, A. B. Yates, chief geologist, R. H. Keast, chief mine engineer, and D. Butchart, master mechanic for mines.

CONISTON SMELTER of the International Nickel Company at Coniston, Ont., 14 miles from Copper Cliff. This plant, built by the Mond Nickel Company and operated by it until the merger of the two companies, is equipped with blast furnaces which smelt all the company's ore which is not concentrated in the flotation plant at Copper Cliff. Photo by Canadian Airmaps Ltd.

At Falconbridge

Though small in comparison with its long-established neighbor at Copper Cliff, the enterprise of Falconbridge Nickel Mines, at Falconbridge, 14 miles from Sudbury, presents the satisfying picture of a substantial, well-rounded and conservatively conducted mining and metallurgical project, for which a bright future seems insured by ample ore reserves and competent technical guidance. Launched some years ago after a careful survey of the economic



possibilities of a field into which few had ventured, the company is now profitably mining and treating approximately 30,000 tons monthly of a nickel-copper ore that has a general average tenor of 2 per cent of nickel plus 1 per cent of copper, and it has definite plans, now well toward completion, looking toward increasing its production by about 25 per cent. Part of the ore produced is concentrated by flotation, the concentrates are sintered, and the sinter, together with the remainder of the mine-run ore, from which merely the coarser waste has been removed by picking, is smelted in a single blast furnace to a copper-nickel matte, which is shipped from Falconbridge to the company's refinery at Kristiansand, in Norway, for separation and refining of the metals. The milling and smelting conducted at Falconbridge were described in *E.&M.J.* of May, 1934. As in all plants, some changes have been made in the elapsed years, and these will be pointed out in the following:

The ore deposit here is directly on the norite contact and not offset from the norite mass, as are the Frood and some other orebodies of the Sudbury basin. Occasionally it has the norite as footwall as well as hanging wall, but usually schist or greenstone form the footwall, with the norite as the hanging wall. The deposit is steep in dip, usually about 80 deg., and is variable in width, this ranging from nothing up to 120 ft. Its wide widths are due to swells, which are ascribed to faulting and which pitch definitely along the strike. The orebody's character as a narrow contact deposit is more pronounced at its west end. Apparently the ore extends for about 7,000 ft. along the strike, with barren spots in places. In character, it is approximately the same as that of the Garson mine, a few miles away and now shut down. Occasionally it contains horses of waste or of altered rock containing some ore.

Two Shafts—One of Them New

Opposite one of the swells of the orebody is located the No. 1 shaft, from which all production to date has come. This shaft is 1,033 ft. deep and 15 ft. 8 in. by 6 ft. 4 in. in horizontal section outside the timbers, and has two cage compartments and a manway. The ore and rock have been hoisted in cars, the combined tonnage raised averaging 1,200 daily, with hoisting on three shifts. This shaft is in the footwall, about 150 ft. from the ore on the first level and 80 ft. on the 1,000 level.

Two years ago, in May, a five-compartment shaft, known as No. 5, was started 2,400 ft. to the east of No. 1 shaft measured along the strike. It was begun in the hanging wall, because the depth of overburden and the amount of water encountered would be less than if the footwall were selected. (On the property the depth of overburden averages 100 ft. and runs as high as 300 ft.) This shaft on June 1 was 1,485 ft. deep and is expected to go to 2,000 or 2,100 ft. and to be in operation this year. It is 13 ft. 4 in. by 19 ft. 6 in. outside the timbers and has two skip compartments, one cage compartment, a manway, and a lined ventilation compartment. Seven levels have been opened, their depths being 200, 325, 650, 825, 1,000, 1,260 and 1,400 ft. Below the 1,400 level, the level interval will be 175 ft. From the 1,200 level, No. 5, connection is also to be made with the 1,000 level of No. 1 by means of an ore pass, after which all ore from the workings of No. 1 will come through the 1,200 level to a crusher station at No. 5. Here will be a 36x48-in. Traylor jaw crusher having a capacity of 180 tons per hour when set to 7 in., and driven by a 125-hp. motor.

A Change in Stoping Method

Shrinkage stoping was used in the No. 1 workings up to a year ago, when a decision was made to change to cut-and-fill, because the walls were sloughing. To do this it is necessary to establish fill passes. The practice now is to use cut-and-fill, with a flat back in sections where the width is 10 ft. or more and rill cut-and-fill where narrower. For filling, development waste and overburden are used, together with some hand-picked waste now coming from the No. 1 shaft rock house.

At present, the total underground force is 260 men.

Little water is made in the mine. At present only 90 to 100 g.p.m. is made in No. 5 workings, and this is handled by one of two 240-g.p.m. pumps on the 1,200 level, where about 350,000 g.p.m. storage space has been provided. In No. 1 shaft, there are four small pumps on three levels.

No. 5 shaft has a 130-ft. steel headframe and has been equipped with two Canadian Ingersoll-Rand single-geared hoists, of 8-ft. diameter and 5-ft. face, having each 2,500-ft. rope capacity. That for handling men and supplies will be driven by a 200-hp., 2,200-volt Westinghouse induction motor and the skip hoist by a 500-hp. motor. Both will wind $1\frac{3}{8}$-in. rope. The present sinking operations are being done with a hoist on the 1,400 level. The compressors at this shaft consist of one 2,800-cu. ft. angle-compound machine and one 1,000-cu. ft. horizontal duplex unit, both of Canadian Ingersoll-Rand make. No. 1 shaft has a 1,500-cu. ft. Belliss & Morcom compressor.

Approximately 30,000 tons of ore is being treated at Falconbridge. Of this about 10,500 tons is milled. Everything has gone over belts in the rock house at No. 1 shaft, where mill and smelter grades have been separated magnetically and where a certain amount has been separated by hand.

A new crushing and separating plant is now being provided and will have three divisions. The first division will be the new crushing section at No. 5 shaft, where there will be a 16-in. Superior McCully gyratory preceded by a grizzly with bars spaced $3\frac{1}{2}$ in. apart. The primary crushing is to be done underground. There will be no separation before the Superior McCully crusher, although provision is being made for hand picking if it proves desirable. The second division is the main separation plant, which will be located over the smelter bins. Here the ore will be screened into three sizes and separated on pulley-type magnets. The low-grade products from these magnetic separators will be sent to the third or fine-crushing division, where they will be reduced to minus-$\frac{3}{8}$-in. size.

The three sizes to be made in the main separation plant will be $-3\frac{1}{2}+1\frac{3}{4}$ in.; $-1\frac{3}{4}+\frac{5}{8}$ in.; and $-\frac{5}{8}$ in. The $-1\frac{3}{4}+\frac{5}{8}$ in. material, called "raggings" and used for converter flux in the last three years, will now be separated into high-grade and low-grade raggings, the former to go to the furnace and the latter to the mill. The $-\frac{5}{8}$ in. material will also be separated into two classes—a high-grade, which will go to the furnace by way of the sinter plant, and a low-grade, which will serve for converter flux. The plant will have in all seven 30-in. Dings pulley-type separators.

In the Concentrator

In the fine-grinding and flotation plant, the practice is largely as it was at the time it was described in the issue of May, 1934, save for relatively minor changes. Another Hardinge mill of the same size has been added on the same classifier, which makes it possible to maintain a greater dilution in the classifier without building up too big a circulating load, with the result that a better grind is effected. Three banks of eight flotation cells each are now used, instead of two as previously. These are all in series. The concentrate from the last (new) bank is returned to the first cell of the first bank. Thickening is now carried out in two Genter thickeners instead of the one filter previously used. In general, mill results are about the same, with a slight improvement in the grade of the concentrates. Grinding is a little finer.

Reagent consumption in the past year was as follows: Soda ash, 0.79 lb. per ton of solid in the pulp; coal-tar creosote, 0.13; coal tar, 0.04; cresylic acid, 0.04; potassium amyl xanthate, 0.10; Aerofloat No. 15, 0.06; pine oil, 0.02; and copper sulphate, 0.09.

Iron consumption in grinding is 2.23 lb. of balls per ton milled and 0.33 lb. of mill liners.

Work being done in the mill in

segregating the sulphides from the gangue has been dictated by metallurgical requirements. The smelter being a one-unit plant, any enrichment of the feed will help in securing the desired increase in output, particularly inasmuch as nothing is being done to raise the grade of ore. The mine ore is as good as before, but better use will be made of it. Also, by greater use of magnetic separation, material formerly wasted will be recovered. At present the blast-furnace charge consists of green ore and sinter mixed. The green ore is the magnetic product of the magnetic separators in the rock house. The two combined constitute the pay load, which is about 76 per cent of the total charge. The smelter staff hope to raise the pay load to just over 80 per cent.

In the smelter, still working toward the desired increase in production, the single blast furnace is to be extended from 15 ft. to 20 ft. in length, this involving knocking out the end jacket and pushing it along the desired distance. In the sintering plant that serves the furnace the length of the 22 ft. x 42 in. Dwight and Lloyd machines is to be increased to 33 ft. by adding more pallets. In the converter aisle where there are now two 26-tuyere 13x20-ft. Peirce-Smith converters, one of these is to be enlarged to 34 tuyeres and a new 38-tuyere 13x24 ft. Peirce-Smith shell is to be added. These changes are to be made simply to increase capacity.

At the same time, to improve operation, a sinter-screening and return system is being installed, to improve the physical character of the blast-furnace feed by removing all minus-½-in. material from the sinter. This fine material will be returned to the feed hoppers located above the machines.

The remaining change, yet to be effected, is to dump the blast-furnace slag hot instead of granulating it, as has been done from the start in February, 1930. Granulating it and elevating it by conveyor is the more expensive way, the granulation, moreover, taking considerable water, which is none too abundant. Further, a ton of granulated slag takes 2½ times the space that it would take if molten. Granulating at the start was justified, it is asserted, for there was a convenient near-by hole to be filled, and the slag was simply run into it through a launder. But as the time came when it had to be not only conveyed but elevated, this justification disappeared. Another consideration is that granulated slag is highly abrasive, and refuses to pack or to be bonded. So on all these counts the company plans to dump its slag molten, and to this end is acquiring a saddleback steam dinkey locomotive and three pots. Dumping space is available within half a mile.

Smelter employees total 118 on three shifts.

A subject of interest at Falconbridge, as at any plant having only one furnace, is the question of furnace shutdowns and the length of campaigns. Here the practice has grown up of shutting the furnace down three or four times a year to put in a new crucible, rebricking the bottom. A technique of shutting down and starting up again with a time loss of only 48 hours, from the time of taking off the blast to restarting, has been developed. During the campaign the furnace is driven hard, 720 tons of total charge being handled in the 15-ft. furnace in 24 hours. When finally the furnace is shut down, practically no brick are left. Gradually the grade of feed has been raised, while the grade of matte produced has been left unchanged, which is done at the expense of the crucible. The maximum possible amount of copper and nickel is being precipitated per square foot of hearth area. Thus they make the most out of the combination of single furnace and a low-grade ore, spending calories and brick to accomplish it, as the superintendent puts it. Moreover, the low-grade matte is used to smelt crude mine ore of intermediate size in the converters, this ore being added instead of barren flux, of which very little is used.

The general objective at Falconbridge is to utilize everything in the ore in the most efficient way. The magnets used really serve to sort the ore and redistribute the sulphides and barren materials so that they arrive at the points in the flowsheet where they have an economic value.

The enterprise is managed locally by E. Craig. J. R. Gill is assistant manager, E. J. Martin, mine superintendent, R. C. Mott, concentration superintendent, and M. J. Tamplin, smelter superintendent. F. M. Galbraith is chief geologist, R. M. Oliver, chief mine engineer, W. J. Mead, mechanical superintendent, and J. Hunt, mechanical engineer.

AS A FALCON might see Falconbridge. In the background are the mill and smelter of Falconbridge Nickel Mines, Ltd., and to the right of these is the townsite. In the foreground is No. 1 shaft, from which has come all production mined to date, and the adjacent miners' dwellings. The new No. 5 shaft is to the left of the picture.

Why High-Grade Ores Are Used For Aluminum Manufacture

Despite the abundance of clays from which the metal might be made—at a price—57 to 62 per cent bauxites low in silica are sought

RELATIVE ABUNDANCE of a metal in the earth's crust is rarely the index of its commercial availability. In fact, from a casual glance at the list of metals, it would appear that some of the rarest require a minimum of technical effort in their commercial production. Tellurium, platinum, gold, and silver, though found in the earth's crust in percentages so small as to defy accurate estimate, are nevertheless found in the native or uncombined state, necessitating only mechanical concentration. Copper, a relatively rare metal when compared to iron or aluminum, also occurs in the pure native state. On the other hand, native iron is found only in fragments of meteorites, and metallic aluminum is never found occurring naturally in the rocks of the earth's crust.

Speaking broadly, the factors which determine the relative commercial availability, that is to say, the price, of any metal, are relative abundance and chemical affinity. The chemical affinity of an element might be defined as its sex appeal to other elements; or, to put it in a more dignified way, as its power of attraction to and combination with other elements. If gold, a rare metal, instead of being rather aloof, chemically speaking, had the power of chemical combination equal to that of aluminum, it would be unknown except as a scientific curiosity in our technical laboratories. On the other hand, if aluminum, the most abundant metal in the earth's crust, occurred in the native state as does gold, aluminum would be universally used for building houses and roads, pavements and bridges, cans and telephone wire, simply because the metal would be so cheap that we could not afford to use anything else. Then, in truth, our world would be an aluminum world, and even a wood-shingled roof would be a rarity.

This factor of chemical affinity makes for many apparently anomalous situations in our metal markets. Virgin copper sells for, let us say, 9c. per pound; and yet much of the world's copper is derived from ores containing 2 per cent or less of metallic copper. In comparison, virgin aluminum sells for about 20c. per pound; and yet the only ores from which it is commercially extracted are the high-grade bauxites containing from 57 to 62 per cent of aluminum oxide, equivalent to 30 to 33 per cent of metallic aluminum. Were it not for this factor of chemical affinity, every clay bank, every stratum of shale, would be a potential aluminum mine, since nearly all rocks except the very pure limestones and sandstones contain some aluminum oxide; and many clays and shales widely and abundantly distributed contain more than 40 per cent of aluminum oxide, equivalent to 21 per cent metallic aluminum.

Aluminum has a strong affinity not only for oxygen but also for silica, and the most common form in which it occurs in nature is as aluminum silicates. The great majority of all clays and shales consist for the most part of aluminum silicates. These aluminum silicates are often complex, with other elements such as calcium, iron, and water combined in them. The greater the affinity between two elements, the more difficult and expensive is their separation. Only by costly and lengthy processes can aluminum silicates be broken down into their component elements so as to yield pure aluminum.

The world's aluminum is made from high-grade bauxite, mined in France, Hungary, Italy, Yugoslavia, Russia, British and Dutch Guiana, the Dutch East Indies, and in this country in Arkansas. To understand why the aluminum producer must select his ores from these sources, many of which are out of the way and relatively inaccessible, instead of putting a steam shovel to work in the nearest clay bank, it is necessary to know how aluminum is made. The same basic process, albeit called by different names in various parts of the world, is universally used, which consists of the electrolyzing of pure aluminum oxide (called alumina) in a solution of molten cryolite in a carbon-lined pot. Only the purest virgin aluminum finds a ready market, even though for fabrication and manufacture into commercial forms it may be alloyed with other metals to give desirable properties. Virgin aluminum of the required purity can be prepared only from the very purest aluminum oxide, as substantially all the impurities in commercial alumina, such as silicon and iron, find their way into the metallic aluminum during its electrolytic reduction. Alumina, or aluminum oxide, of the required purity can be prepared by a number of processes, but the most economical process has been found to be the Bayer process, or variations of it.

Simply stated, the Bayer process consists in digesting the bauxite with a hot solution of caustic soda, by which the aluminum hydrate in the bauxite is dissolved and the impurities—silica, iron oxide and other undesirable materials,—are left behind as mud. The mud is filtered off and the aluminum hydrate is precipitated from the solution by appropriate methods and is then calcined to drive off the chemically combined water, leaving relatively pure alumina. The raw materials for this process consist of bauxite and soda ash (sodium carbonate), the latter being causticized by means of quicklime; so that in reality there are three basic raw materials—bauxite, soda ash, and limestone.

The amount of soda ash required depends upon the amount of siliceous impurity (clay) in the bauxite. For every pound of silica present, more than a pound of soda ash is consumed and wasted in the mud which is discarded. At the same time, this pound of silica carries away with it about a pound of alumina, thus increasing the losses. For each pound of soda ash consumed, nearly a pound of quicklime is required to convert the soda ash into the form of soda lye or caustic soda, in which it must be used. Additional lime required means more kilns, and more fuel and labor, as well as additional limestone and extra material to be handled and discarded in the process. Though fuel has not been classed as a basic raw material, it is an extremely important factor in the cost of producing alumina, as large quantities of heat are required in the Bayer process and in the preliminary treatment of the raw materials used in that process.

As stated in the foregoing, bauxites currently used in the production of aluminum contain from 57 to 62 per cent of aluminum oxide, or alumina. They also contain varying amounts of impurities, such as silica, iron oxide, and titanium oxide. By far the most troublesome impurity is silica, by reason of its direct influence on the quantity of other raw materials and fuel used in the Bayer process. Hence, commercial bauxite used in the manufacture of

alumina must contain a minimum of siliceous impurities, and in the ores currently used the percentage of silica varies between 1½ and 5½ per cent.

As already stated, many common clays and shales contain more than 40 per cent of aluminum oxide. But these clays and shales also contain from 35 to 50 per cent of silica; that is from 10 to 20 times as much silica as is found in high-grade bauxite, and this high silica content would make the production of alumina from clay prohibitively costly.

Inasmuch as the presence of so much silica renders it impossible to extract alumina from clay by the alkaline process, many inventors have attempted to accomplish this result by the use of a variety of acids. These acid processes have the advantage that they do not generally dissolve the silica, and it is fairly easy to get the greater part of the alumina separated from the silica. However, they always dissolve the iron with the alumina, and there is at present no satisfactory and economical method of separating the iron and alumina in such acid solutions so as to get aluminum oxide of the desired purity. Also, there is always a considerable loss of the acid in the course of such separations and in converting the aluminum salts into aluminum oxide, and these losses add very largely to the expense of the process. The result is that though it is possible to extract aluminum oxide from clay by any one of a variety of processes, the costs involved in doing so are so much higher than the cost of extracting alumina from bauxite that no one can afford to use clay as long as suitable bauxites are available at current prices.

Educational Qualifications For Mining Engineers

Survey shows that a degree in engineering is almost a prerequisite to obtain professional status and a position

HOW essential to success in an engineering career is the completion of a college course in engineering? Are opportunities in engineering increasing or decreasing for men without formal technical training? How important is postgraduate study? Do engineering graduates generally practice in that branch of the profession for which they were trained, or do they transfer to other kinds of work? Answers to these questions are contained in the results of a survey of the engineering profession conducted by the Bureau of Labor Statistics in May, 1935, at the request of American Engineering Council. The first of a series of summary articles on the subject appeared in *Monthly Labor Review,* June 1936, published by the Department of Labor, Washington, D. C.

The principal purpose of this survey was to determine how the engineers fared during the depression period. However, to provide a comprehensive background for these data, the survey was extended to include the salient features of education and subsequent experience, so that the nature of the general trends affecting the profession could more readily be determined. Unquestionably, a knowledge of trends is of inestimable value to administrators of professional engineering education and to the practicing and prospective engineer.

Data were obtained by means of a mail questionnaire addressed to 173,151 engineers. The net number of usable returns was 52,589, or 30.4 per cent. Returns covered every State and the District of Columbia, ranging from 101 in Nevada to 7,659 in New York. Engineers reporting were grouped into nine major professional classes, one of which was mining and metallurgical engineering, numbering 2,187. The range in numbers was from 388 for ceramic engineers to 19,891 for civil engineers.

Analysis of the returns shows that engineering graduates as a group find employment and continue in the branch of engineering for which they specialized in college; that the great majority received their first degree in engineering; and that postgraduate study is not generally pursued. It also shows that "other engineers" (those with unfinished or no technical training) in engineering work are diminishing in number as the older age-groups retire from active service.

Of the 2,187 mining and metallurgical engineers reporting, 87.3 per cent were college graduates. Not all, however, were graduates in mining and metallurgy. Among the graduates who were in the profession for which they had specialized in college—mining and metallurgy—nearly 90 per cent had their first degree in engineering. The remainder had master's and doctor's degrees also. Similarly, among the graduates practicing mining and metallurgical engineering, but who had not specialized in that branch in college, 84 per cent had their first degrees in engineering and the remainder had, in addition, master's and doctor's degrees. This latter group numbered only 278. For all classes of engineers the proportion who were in another branch of engineering than that for which they had specialized was only 8.4 per cent.

From all of which it may be concluded (1) that a great majority of men reporting mining and metallurgical engineering as their vocation are college graduates who specialized for their present profession; (2) that postgraduate work leading to master's and doctor's degrees is not regarded as important by this group; and (3) that the extent to which civil, mechanical, and other engineers transfer from their course of specialization to mining and metallurgical engineering is somewhat greater than for all engineers as a class.

Classified by fields of activity and functions performed, the highest percentage of mining and metallurgical engineers is in extractive industries, where 47.3 per cent were employed. Over 27 per cent reported manufacturing as their activity. The next two highest were 11 per cent each for personal service and government work. As for distribution by function, the highest percentage appears in operation with 43.4, followed by design and research with 19.4; and 11.2 per cent report consulting as their functional classification, this being the highest percentage for any of the nine major professional groups.

That the number of technically untrained men in the engineering profession is rapidly waning is shown by a table giving the number of such engineers according to birth periods. The results of the survey emphasize the fact that the chances of attaining professional engineering status and holding an engineering position without a college degree have markedly decreased.

Drilling the Round

The Machine, the Column, and the Steel . . . A Word on the Explosives

• III •

Reed E. Roberts

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WITH respect to equipment, there are so many good drills to choose from, and so many different opinions as to which is the best, that it takes close observation to find out just which one gives, in the long run, the best return for the money expended.

Oftentimes one tends to put too much faith in a machine on its being operated by an expert. Such a man can take an inferior machine and with it outdrill a mediocre driller who is running some other drill.

When a machine is worn out the service man should be consulted. If he agrees that it is worn out, it had best be scrapped. One makes a great mistake to keep on using a machine when it ceases to give good results after all the parts that show wear have been replaced. Everything wears out in time, and it is much better to accept the fact than to spend the price of a new machine in repair parts and get half the service, plus twice the grief.

A close check should be kept on repair parts and labor, for only thus can the equipment be known, and whether it is receiving the proper care. If a machine does not perform properly, there is a reason. If it is the driller's fault, this should be rectified. If the manufacturer's, he should consider it a privilege to remedy the trouble.

An excellent way of keeping costs on machines, cars, and other equipment is found in the card system. Cards should be printed showing the date, make of machine, serial number, name of operator, remarks, date repaired, repairman's name, repair parts used, time, condition of the machine when sent in to the mine, and the condition when sent out. These cards can be turned in with the regular time cards. A clerk can compile these data once a month so as to show at a glance the cost of repairs on each machine.

One should not try to drill rock that is too hard with a drill that is too light, for it will not stand up. Nor should soft ground be drilled with a heavy machine. The right machine should be selected for the job, as much as the right man for the job.

The same care should be taken of the column as of the machine when it is taken down. It should not be laid in the water nor left where flying rock will dent it. A little oil should be put on the jackscrews, nuts, and other parts. When a nut has to be tightened to change the position of the machine, the machine man should not have to use both hands and exert his full strength to do it.

In surprising contrast is the rapid progress made in building rock drills in the past 25 years and the general lack of it in building columns. The same column for the most part is employed today as was used when drills first came out. It is heavy, cumbersome, and slow. An exception is a pneumatic column put out by a Denver manufacturer. One of these was used and observed for a year, and I cannot recommend it too highly. With it can be saved 30 minutes to one hour on every set-up. It requires no blocks or wedges. One man can set it up as easily as two. The head of the column is swiveled. It adjusts itself to any irregularity in the rock, thus saving the time taken up in picking down a smooth place to put the head block, as is necessary with the old type of column. The comparison in Fig. 22 shows some of the advantages of this column.

One should note the angle of the head of the pneumatic column. Due to the great pressure exerted by the jack nut, it stays there. Moreover, it was found unnecessary to tighten it as often as the old type column. In drilling lifters it is not necessary to lift the weight of the machine and arm above the jackscrews to swing it around into position to drill on the other side.

In buying drill steel a good grade should be selected. Here often can be taken one of the most importance steps in cutting drilling costs. If several different brands are bought with the idea of finding which is the best, the purchase of each should be limited to a small amount. But the steel so bought should not be mixed up with the other steel and the matter of deciding which is best left to the drillers. In the first place, the sharpener cannot distinguish the different brands while dressing steel. Generally he determines his heat by eye. A given heat that is right for one steel is wrong for another. In other words, a mixed batch of steel, regardless of how good the sharpener may be, will include some that has been tempered properly, some that is too soft, and some that is too hard. The result will appear in broken and battered steel, even though all the steel is of good quality.

Some of the larger mines are so equipped as to take all the guesswork out of steel sharpening and tempering, but unfortunately the majority of them are not; hence these precautions. One will do well to standardize on a certain steel and eliminate such hazards.

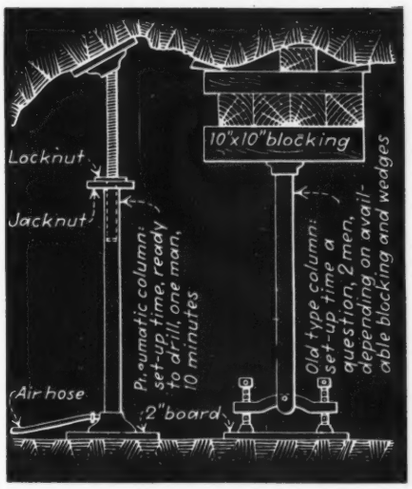
10"x10" blocking
Locknut
Jacknut
Air hose
2" board
Pneumatic column: set-up time, ready to drill, one man, 10 minutes
Old type column: set-up time a question, 2 men, depending on available blocking and wedges

FIG. 22—TWO DRILL COLUMNS, in contrast. On the right, one of a sort extensively used and offering many disadvantages as compared with the newer pneumatic column on the left

A common practice of drill sharpeners is to give most of their attention to getting a good cutting edge or bit on their steel, which they have properly tempered, and to pay little or no attention to the shanks. Others make it a practice to check up on their shanks every thirty or sixty days. This is a mistake. The shank is as important as the bit. A shank must be tough enough and hard enough not to batter or break, and should be the proper size and length. It should be tempered in oil, not water, and should be perfectly smooth on the end, so that the piston, on striking it, will strike over the whole area and not on one or two high points, which will crack or chip the piston. The cost of repair parts, such as pistons and water needles, may be as high as $40 in one week on one machine, due to nothing but inferior shanks. A good shank grinder will keep shanks and pistons in perfect condition, add many hours of service to their lives, eliminate costly repair bills on broken or cracked pistons, and maintain their efficiency. The sharpener should be impressed with the importance of watching both ends of the steel until it becomes a habit.

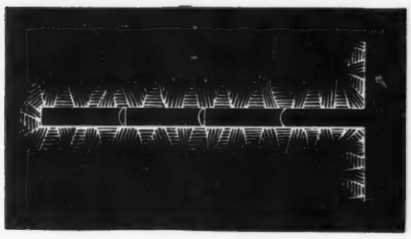

FIG. 23—DYNAMITE TAMPED with a stick having a pointed or uneven end will have depressions formed in the ends of the cartridges, giving air pockets which may cause part of the charge to remain unexploded

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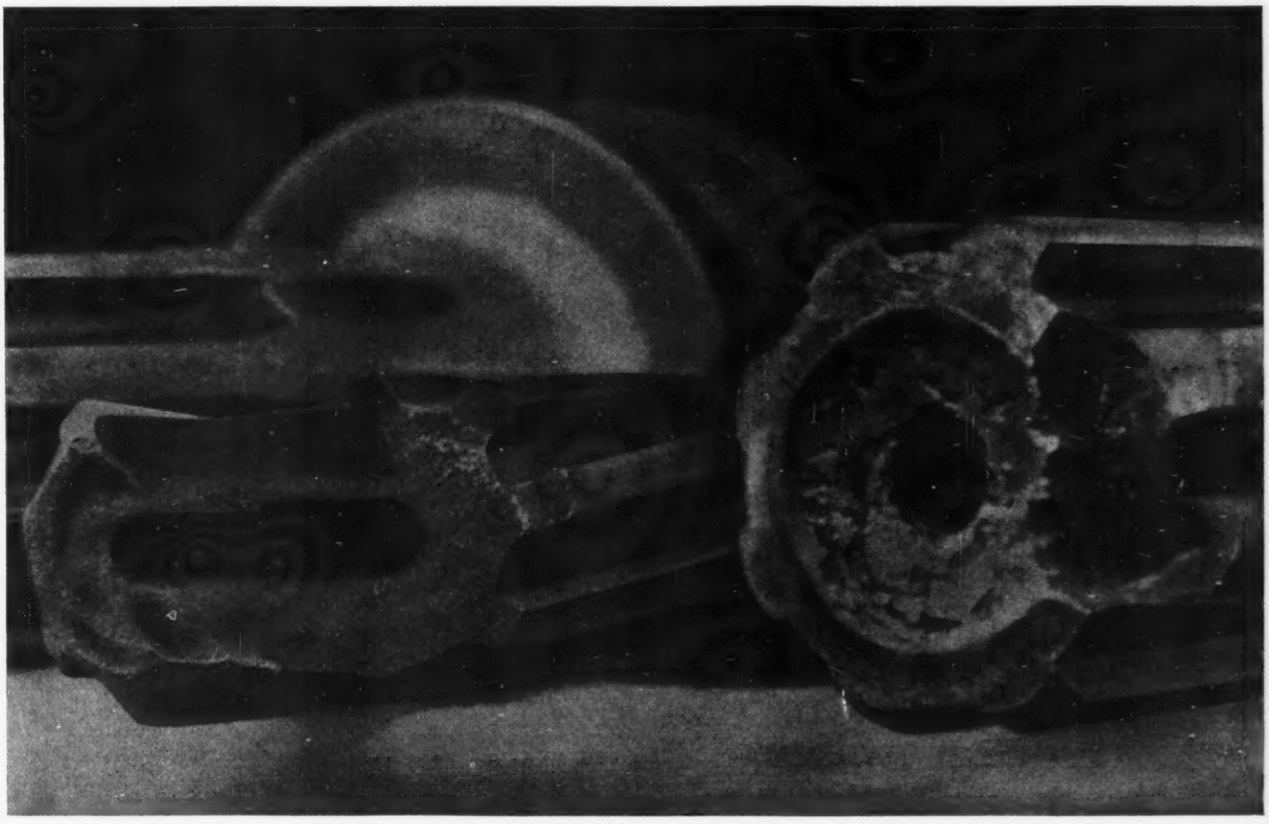
BROKEN PISTONS such as these are caused by use of drill steel having imperfect shanks. The repair bill may be high if the shank is not given proper consideration

Steel, as a rule, gets less care underground than does any other equipment. It is used for bars, thrown down in the mud and water, and allowed to rust and plug up in the water tube. If it is slightly bent, it will not rotate freely and it will cause excessive wear on the machine, this often giving a broken shank. If it is allowed to rust, enough water cannot get through the tube to clear the bore out, and a stuck steel results. Time is lost and often the steel is destroyed in blasting it out.

Dry racks should be provided for steel, so that it does not have to lie on the ground or stand in the mud and become choked. The lengths should be checked once a month. Sufficient finishing steel of the proper length should be kept on hand to maintain the depth of the standard round. Moreover, adequate means should be provided for getting steel to the drillers in sufficient quantity, so that they may complete their drilling in the allotted time.

The accompanying photographic cut shows the results of drilling with steel having inferior shanks. One may note the cracked, chipped, and broken pistons caused from uneven, hard shanks. To replace one of these pistons very often will make the repair bill high.

Blasting and the selection and use of explosives constitute a phase of



mining which is badly neglected in most small mines and in many of the larger ones. Often the amount of powder to be used in loading a round is left to the discretion of the driller, who, according to my own observation, is only too likely to use 20 to 50 per cent too much. This, in my opinion, is due principally to the lack of stemming or tamping, without which the maximum breakage cannot be secured. Full information on this subject may be had for the asking from any of the leading explosive manufacturers, who will be glad to cooperate in training men to use the proper explosive in the right way.

Experience shows that the best results are obtained by instructing miners as to the amount of powder to use in each round, for the average individual is not interested in the matter to the extent of spending any time in studying his explosives. This can be done by the foreman and shift bosses, whose business it is to visit all faces and supervise and direct all operations.

One way by which a company's management can be sure of cutting down powder consumption is to provide stemming and to designate so many sticks of tamping per hole, just as is done with dynamite. Screenings, mill tailings, sand, and clay can be used; clay is considered the best. Good tamping sticks should be provided, because an improperly loaded hole will rarely break well.

When a stick of powder is exploded it changes immediately from a solid to a gas. The pressure exerted by this gas is what breaks the rock; hence the necessity of confining it as much as possible. The rapidity of the transformation in the powder makes it impossible to follow it, but this is exactly what takes place. All powder manufacturers make tamping cartridges that can be obtained with the powder. Several machines also are manufactured for filling them. Moist clay should be used if it is obtainable. If it is not, something else should be selected. At all events tamping should be used, as it gives a better break and saves powder.

Detonators of the proper strength should be selected. The powder manufacturer will recommend the one best suited for a particular work. The cap should be pointed toward the bulk of the charge in the bore for best results. Tamping sticks should have smooth ends as large in diameter as the cartridge, so that the powder can be tamped down firmly. Iron or steel should be used in tamping a hole.

Fig. 23 shows one result of tamping a hole with a stick that has worn down on the end to a point. One may see the air pockets thus formed between each stick of powder. These act as cushions and often are responsible for leaving one or two sticks of powder unexploded in the bottom of the hole.

In general, loading a round properly and firing it deserve more care than is usually given these matters.

(To be concluded)

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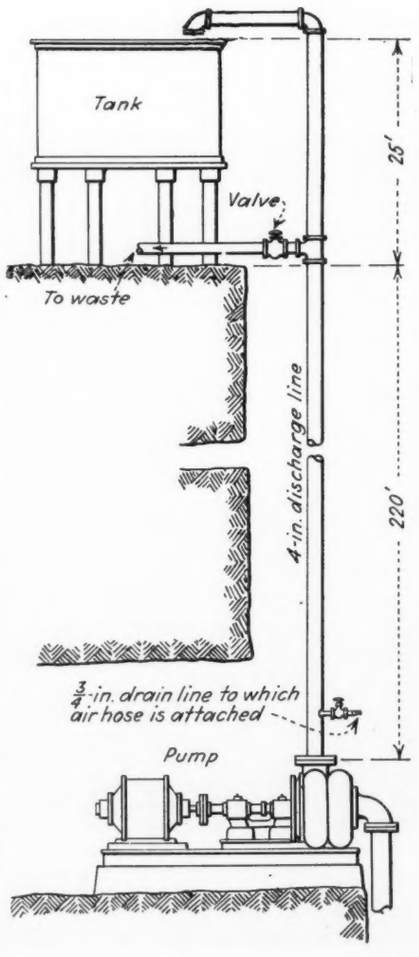
A Pump Problem Solved

AT THE RUDISIL MINE, near Charlotte, N. C., operations were interrupted recently when a defective centrifugal pump stopped the water supply for the compressor plant, writes Daniel B. Gregg, of Rudisil Gold Mine, Inc. The unit in question has a capacity of 500 g.p.m. when pumping against a head of 400 ft., and delivers mine water from the 220-ft. station to a storage tank about 25 ft. above the surface or collar of the shaft. To avoid a long shutdown, a smaller centrifugal pump was installed immediately. But upon starting pumping operations it was found that the capacity of the emergency unit was inadequate to lift the water the required 245 ft. The idea of installing an available Cameron steam pump to be driven by compressed air had to be ruled out because of the long time required for erection, the possibility of freezing up of the air end, and excessive air consumption.

Lacking other suitable equipment, the problem was successfully solved in the manner indicated in the accompanying sketch. The 4-in. discharge pipe of the pump was provided with a ¾-in. valve connection, to which can be attached the air hose of a rock drill. This connection is just above the head of the pump. The arrangement converts the discharge line into an air lift, the small amount of air entering the pipe through the ¾-in. valve supplying the extra power needed to lift the water to the storage tank.

After a short period of operation it was found that less air pressure was required when turning on the air before the pump had filled the discharge column. As mentioned previously, the pump was installed 220 ft. below the collar of the shaft, but had it been deeper the connection would have had to be made at a point which would provide a water column head lower than the delivered air pressure.



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Lithium in North Carolina

SINCE the article "Lithium in North Carolina" (*E. & M. J.*, July, 1936) was written, the author, Frank L. Hess, has had further opportunity to study the spodumene pegmatites near Kings Mountain, and writes that he finds it quite probable that all of them are replacements of aplite dikes. At the old Faires workings, cassiterite was found in the same hand specimen with spodumene, and on the Dearmon place, at the southwest end of the pegmatites, a small crystal of white beryl was found by Charles Hunter.

At Lincolnton, in company with Stewart St. Clair, Dr. Hess found the quantity of spodumene, though greatly weathered, to be much larger than he had thought from his observations made on a former visit. He states that Dr. Oliver C. Ralston has suggested the use of spodumene in pottery, especially in glazing, and says that the application of this idea seems probable.

The Comstock Still Produces

Nevada's historic district today affords a view of varied metallurgical practice in the plants of the several companies

J. B. Huttl
Assistant Editor

THE Comstock Lode in the Virginia City-Gold Hill-Silver City mining area, now in its seventy-fifth year, continues to be more than active, despite such periodic setbacks as the closing of the Comstock Merger mine operations in 1926 and the subsequent dismantling of the 1,000-ton mill at American Flat. Though the camp experienced later a modest recovery, chiefly brought about by the successful opening of the Flowery mine, in Six Mile Canyon, in 1928, by the late Alex Wise and associates, it was not until 1933, when the price of gold was enhanced by government fiat, that an appreciable increase in mining activity was experienced. During my recent visit to Virginia City I found a dozen mills in operation, treating an aggregate of about 1,100 tons of ore a day and providing both employment and modest earnings for the owners.

The interest of the mining engineer or metallurgist visiting the Comstock is immediately aroused by the wide difference in the processes employed at the various reduction plants in treating ores that closely resemble one another. Here the visitor has the opportunity to study the recovery of precious metals by flotation, amalgamation, and cyanidation as well as various underground mining methods, as for instance square-set, cut-and-fill, and rill stoping, including open-pit work for removing a highly oxidized quartz ore at several properties. About 70 per cent of the ore treated at the mills is mined by the last-named method. Equipment used in this operation consists of a gas shovel and 5- or 10-ton trucks, and the work is usually done on contract. Ore values mined on the Comstock Lode today average from 0.06 to 0.20 oz. gold and from 1.20 to 5.8 oz. silver per ton. Activities underground are centered chiefly in development work.

The flotation mills active in the district follow standard design, employing a jaw crusher for primary crushing, gyratory or Symons cone crushers or rolls for secondary crushing, ball mill with classifier for grinding to a fineness of from 2 to 5 per cent on a 60- and 65-mesh screen respectively, followed by successive treatment of the pulp in a conditioning tank, rougher and cleaner cells, thickener, and settling boxes. Drying pans are used for reducing further the moisture content of the finished concentrates before shipment to the smelter.

Amalgamation plants stamp through 40-mesh screens, followed by inclined tables and grinding pans, and cyanidation of the tailings. Most of the cyanide mills employ the conventional counter-current system of cyanidation, the equipment consisting of a jaw crusher, gyratory or cone crusher, ball mill with classifier, primary thickener, agitators, secondary thickeners, continuous filters, and precipitation machinery. Grinding is done to 60 or 100 mesh, depending on the character of the ore treated. After the aforegoing brief summary a description of the properties active on the Comstock Lode may be of interest.

When entering the Virginia City district from the north, the first mining property encountered by the visitor is that of Sierra Nevada, Ltd. The mine proper is opened by what is locally known as the Reilly tunnel, but only 30 per cent of the ore treated at the mill is obtained from underground development work, the remainder consisting of dump material trucked to the crushing plant from old mine dumps. Capacity of the flotation plant is 100 tons. Primary and secondary crushing are done in a jaw crusher and a set of rolls, which is followed by grinding in a grate-type ball mill equipped with a hydraulic gold trap and operating in closed circuit with a Dorr classifier, The overflow goes to a four-cell Kraut rougher after being conditioned in a mechanical agitator. Rougher concentrates flow to a two-cell Kraut cleaner, the tailings returning to the conditioner tank and the finished concentrates going successively to a series of settling tanks and an oil-fired pan drier. Rougher tailings pass over two Plat-O tables before entering the wooden launder leading to the pond. The concentrates from the tables are added to the cleaner product in the settling tanks, and the material removed from the hydraulic trap is treated in an amalgamating barrel. An automatic sampler is installed in the tailings launder. Operations at the property are under the direction of A. B. Thomas, general manager.

Just south of the Sierra Nevada enterprise, in the heart of Virginia City, are the operations of the Arizona Comstock Corporation, W. J. Loring, president. This is the largest producer on the Comstock. The highly oxidized gold-silver ore is mined from an open pit just off the highway by a 1½-yd. gas shovel and hauled in 10-ton trucks to the crushing plant. Precious-metal content of the quartz ore, which carries considerable clay from gouge and country rock, averages 0.10 oz. gold and 4.0 oz. silver per ton. The gold is mainly in a free state, though somewhat rusty, and the silver as both chloride and sulphide. Treatment at the 350-ton mill consists of crushing the ore in a Blake and gyratory crusher, followed by grinding in a Hardinge and a Marcy mill, both operating in closed circuit with a Dorr classifier. The flotation department contains an eight-cell Denver rougher unit, a twelve-cell Kraut rougher machine, a four-cell Kraut cleaner, and an additional eighteen-cell

SIERRA NEVADA, LTD., near Virginia City, operates this 100-ton flotation plant, which treats ore from underground development and near-by dumps

ARIZONA COMSTOCK CORPORATION carries on its mining operations within the limits of Virginia City. Highly oxidized gold-silver ore is treated in its 500-ton mill

Kraut unit has been installed. Addition of extra flotation equipment has resulted in a 15 per cent increase in the recovery of gold and a 10 per cent increase in the recovery of silver contained in the ore. The previous total value recovery in the concentrate was about 65 per cent of the gold and 55 per cent of the silver contained in the ore, or a combined value extraction of approximately 60 per cent. The management expects to raise this figure to 80 per cent in the near future. Classifier overflow, 60 mesh, is first treated in a conditioner tank before entering the flotation units. Finished concentrates go to a Dorr thickener, the underflow being treated in both settling boxes and wood-fired drying pans. Tailings are impounded below the mill for future treatment in a cyanide plant now partly constructed. Ratio of concentration is about 400 to 1, and the concentrates assay $1,300 per ton. Dried concentrates are trucked to the Selby smelter. The mill is treating about 375 tons of ore a day at the present time.

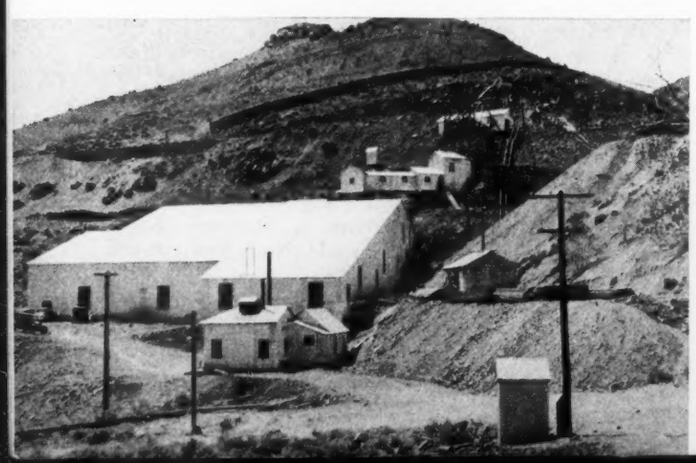
Consolidated Virginia Mining Company, which has extended and enlarged recently the old Central tunnel, continues work on the comprehensive development program started more than a year ago and is now sinking the Mexican winze another 100 ft. and opening up old drifts and crosscuts in the Burning Moscow property preparatory to sampling and future development. Zeb Kendall is president of the company, and an option on a controlling interest is held by J. J. Raskob and Eastern associates.

Just below Gold Hill, and in the central section of the Comstock, is the Crown Point mine of Sutro Tunnel Coalition. The company has recently completed the construction of a 100-ton cyanide mill with the aid of an R.F.C. loan to work the upper levels of the mine. At present the mill is treating about 120 tons of oxidized ore a day averaging 0.20 oz. gold and 5.8 oz. silver. The ore milled is obtained both from underground development work and from an open pit. It is crushed to 1½ in. in a jaw crusher and ground in a No. 66 Marcy ball mill with a Dorr classifier, the 100-mesh overflow going direct to the primary thickener. The overflow from this tank is directed to the precipitation plant, and the underflow is successively treated in two agitators, thickener, two agitators, a third thickener, Oliver filter, and a pulping tank. Operations at the property are directed by J. M. Leonard, of Virginia City.

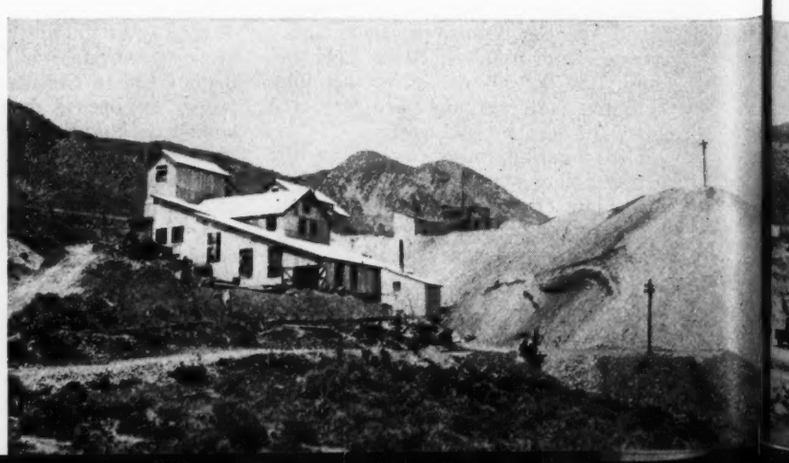
A short distance south, the Consolidated Chollar Gould & Savage Mining Company is operating a 300-ton flotation mill on the Overman mine. The plant is milling chiefly old mine dumps that contain low-grade mixed oxide and sulphide ore. This material is mined with a ⅜-yd. gas shovel at the Belcher, Overman, and Yellow Jacket dumps and hauled in 5-ton trucks to the reduction plant, which is treating nearly 400 tons a day. The flowsheet of the mill varies little from those described previously. Following primary and secondary crushing in a jaw and cone crusher, the ore is ground in a No. 86 Marcy ball mill in closed circuit with a Dorr classifier, and the 2 per cent plus 60-mesh product conditioned in a mechanical agitator prior to treatment in a six-cell Kraut flotation unit. Concentrates from this machine go to a Kraut cleaner, and the tailings flow to two six-cell Kraut rougher machines. Final tailings are passed over four Wilfley tables and the middlings return to the grinding circuit. A Dorr thickener, settling tanks, and electric dryers handle finished concentrates. Mill heads average 0.06 oz. gold and 1.20 oz. silver, ratio of concentration is 100 to 1, over-all recovery 80 per cent, and the heavy sulphide concentrate sent to the Selby smelter is valued at $250 per ton. F. V. Dempsey, superintendent, is in charge of operations.

The operators of the Overland mine, about 2 miles east of Gold Hill, have increased the capacity of the 35-ton mill to 100 tons by replacing the ten stamps with a ball mill and classifier

SUTRO TUNNEL COALITION COMPANY is now operating its new mill and treating daily about 120 tons of oxidized ore which averages 0.20 oz. gold and 5.8 oz. silver



SOUTH OF GOLD HILL, the Consolidated Chollar Gould & Savage Mining Company operates. Ore comes mostly from dumps and is hauled to the 300-ton flotation plant



OVERLAND MILL has recently increased its capacity from 35 to 100 tons. A battery of ten stamps is used for secondary crushing. The plant is shown in this cut

HARTFORD MILL, near Silver City, is a 75-ton cyanide plant where additional equipment has been installed and the flow-sheet rearranged. Below the mill is the Silver Hill open-cut mine

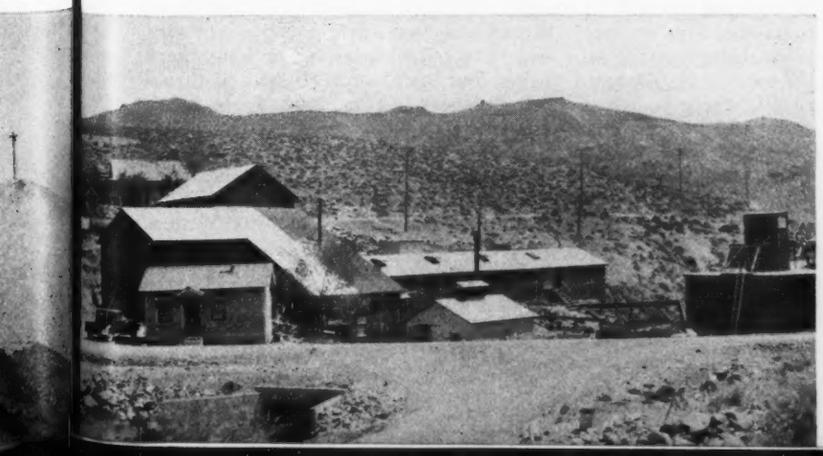
and additional flotation equipment. The stamps are used for secondary crushing. Gold-silver ore obtained from underground development work is of the oxidized type, carrying only a small percentage of sulphides, and with most of its values in free gold. At the near-by Justice mine, leased to the Dayton Consolidated Mining Company, a vigorous development program is being carried out, and about 40 tons of ore is trucked daily to the company's cyanide mill below Silver City. West of the Justice mine is the old Hartford property, where a 50-ton cyanide plant is available for milling. This mine has recently been leased by Howard W. Squires, who is rebuilding the mill. Extra machinery and tanks are being added to increase the capacity of the plant to 75 tons. The mine is worked by leasers. Below the Hartford mine are the workings of the Silver Hill Mining Company, operated by William Donovan, lessee. Ore mined from underground workings and open pits is trucked to the 50-ton cyanide plant at Silver City.

In the Silver City area five mills are more or less active—the Donovan, a 50-ton cyanide plant; Trimble, an old-time straight stamp-amalgamation mill with a capacity of 35 tons a day, chiefly milling custom ores; South Comstock, also known as the Recovery mill, a 70-ton combination amalgamation and flotation plant; the 35-ton Clack mill, equipped with a crusher, slow-speed Lane mill, amalgamation plates and pans, and tables; and the 50-ton Esher mill, which is operated intermittently. Tailings from the Trimble mill are treated in the Donovan cyanide mill near by. At this mill the ore is stamped through 40-mesh screens by a ten-stamp battery, the crushed product passing over amalgamation tables into grinding pans. Pulp, and tailings from the Trimble mill are classified in a Dorr bowl classifier, the sand going to a Butters and Mein distributor and thence to four leaching tanks, and the overflow to two settling ponds. A further separation of fines and sands is made here. The slimes are pumped to a thickener, the underflow being treated in agitators and a second thickener and the solutions in zinc boxes, while the sands are removed by a clam-shell excavator for farming and leaching. An over-all extraction is made of 90 per cent or better, and the bullion produced is sent direct to the United States Mint at San Francisco.

Below Silver City the Dayton Consolidated Mining Company continues to operate its 150-ton cyanide mill on ore received from the Dayton and Justice mines. Mining operations at the Dayton mine are confined above the 400-ft. level, and about 120 tons of ore is sent daily to the mill. Ore is mined by square-set, cut-and-fill, and rill stoping methods. It is an oxidized gold-quartz ore, the ratio of gold to silver being about 1 to 5 by weight, but by value 10 to 1. Metallurgically, the silver is of minor consideration. The machinery contained in the mill is that of the old Flowery plant, which was moved to the Dayton property and erected in the same manner as when in use at the Flowery mine. Daily production is 160 tons. The ore is crushed in two stages in a jaw crusher and gyratory crusher, and then ground to 30 mesh in a ball mill in closed circuit with a Dorr classifier. This is followed by grinding to 60 mesh in a tube mill also operating in closed circuit with a Dorr classifier. The 60-mesh product goes direct to a thickener, whence the overflow passes to settling tanks, clarifying press, and zinc-dust precipitation, and the underflow to three agitators, a second thickener, two continuous filters, and a mixer. Cyanide consumption is about 0.4 lb. per ton; that of lime reaches 10 lb., to obtain the necessary settling. A total recovery of 97 per cent is made. Bullion is shipped direct to the United States Mint in San Francisco. Homer Gibson is in charge of operations.

About 4 miles from Silver City, the Dayton-Douglas Cyanide Company is treating tailings from the old Douglas mill in a 100-ton cyanide plant.

DONOVAN MILL is a cyanide plant capable of treating 50 tons of custom ore per day and in addition the tailings from the neighboring Trimble mill. It is shown in the illustration



DAYTON CONSOLIDATED operates this 150-ton cyanide plant, which treats gold-quartz ore from the Dayton and Justice mines. Square-set, cut-and-fill, and rill stoping are used.

The Metalliferous Altai Of Soviet Russia

· III ·

Milling Facilities For Treating Complex Ores Are Increasing

Andrew Meyer and Edith Meyer

Mining Engineer *Metallurgical Engineer*

IN THE REGION of the Altai Mountains, metallurgical interest is confined at present to three places: Ridder, where there is a concentrator handling about 1,000 tons of ore daily, a lead smelter and refinery, a small electrolytic plant producing cadmium, a small sulphuric acid plant, and accessory apparatus; Zyrianovsk, where a mill is handling about 250 tons of ore daily; and third, Belousovsk, where there is a pilot mill. Ridder is, of course, the most important of the three as a producer.

It should be mentioned in passing that formerly there was a smelter at a place called Ekibastus. A lead smelter had been erected after the Great War on the Irtish River at the port of Glubokaya. The Ekibastus smelter has been completely dismantled and the other partly so, with some pieces of equipment from both places functioning at Ridder today.

Taking them in the order of importance, it is intended in this article to cover the salient features of the metallurgical activities of the Altai region as they are at present, with brief comment on the difficulties existing and the future plans and prospects for the region.

Table I published in *E.&M.J.* of July, p. 350, gives the amounts of metal produced up to 1910, which covers 80 per cent of all the ore mined. According to the records of the Cabinet, up to 1910 2.6 tons of gold was produced, 3,339 tons of silver, 28,728 tons of copper, and 125,040 tons of lead. We believe these figures to be considerably lower than the actual production of this period, as it is stated elsewhere that many profitable enterprises were never reported to the Cabinet. However, in January, 1934, the total reserves for the Altai were reported as in Table VII.

Parts I and II of this article appeared in the June and July issues respectively.

The Ridder property is spread around the base of a low knobby hill which rises gently from the valley floor that is watered by the Filipovka, Tikaya, Gramatukha, and Bistrushka river streams, all emptying into the Ulba River.

The present mill consists of a small, whitewashed, wooden building known as the old mill and a large concrete structure with many windows, known as the new mill. The old mill is a relic of the pre-revolutionary days. It contains some new equipment and treats about 250 tons of ore daily. The new mill was erected during 1929-30 on the site of a previous mill which was destroyed by fire. It consists of four parallel sections, each of 250 tons' capacity. During 1934 and 1935, the old mill and sections 1 and 2 of the new mill were operating continuously. Section 3 was installed in 1935 and Section 4 is to be set up during the present year.

The coarse-crushing equipment is housed in a building adjoining the Gregorovsky shaft, and ore hoisted in skips is dumped directly into large wooden chutes feeding the coarse crusher. Ore from the Sokolny adit is transported on flat railroad cars (about 1 km. from adit face to mill), and shoveled into a small bunker under the tracks, and from there again shoveled into wagons, which are pulled up a short incline leading to the same chutes that feed the coarse crushers.

The ore fed is limited to 300-mm. size by grizzlies set on the underground bin. A Telsmith No. 13-A gyratory operated by a 60-hp. motor is the primary crusher and is set to 75 mm. Another crusher of similar capacity, and of Esche-Werke manufacture, stands in reserve. The 75-mm. product is conveyed on a belt to a 4-ft. Symons crusher operated by a 75-hp. motor. This crushes to 13 mm., the product being carried on a belt conveyor (112 m. long by 600 mm. wide) to the new mill, where is passes over a Merrick scale and to the bins. The ore bin of the old mill has a capacity of 1,000 tons. That in the new mill has been recently enlarged to 3,000 tons' capacity. The motor that drives the Telsmith crusher is of Allis-Chalmers make, but the others are of Soviet manufacture.

Ore from the bins is fed to No. 75 Marcy ball mills working in closed circuit with double-rake Dorr classifiers. These mills use 3- to 5-in. balls and are run by 150-lb. Westinghouse motors. The rake classifier is 6.5x1.8 m. in dimensions and is set on a 15-deg. incline. The sands from it are sent back to the grinding mill and the overflow runs to a 4.5-m. Dorr bowl classifier. Overflow goes to the primary flotation by a launder, from which the mill-heads sample is taken regularly.

The mine ore sent to the mill is fairly rich and has a specific gravity of 3.2. Based on microscopic studies, it has been judged necessary to grind the ore to not less than 80 per cent minus-200 mesh.

Sands from the bowl classifier are passed by a screw feed to an 5x7-ft. Allis-Chalmers ball mill, using 3-in. balls. The product from this runs generally 75 to 80 per cent minus-200 mesh and joins the overflow from the bowl classifier and goes to flotation. At intervals the heavy sands which collect in the classifier are washed out and then run through what is known as the gold section. This consists of two Deister Plat-O tables in series, which make a concentrate carrying practically all the free gold, and a table tailing, which carries sulphide minerals and is returned to join the rake classifier feed.

The procedure in the Ridder mill is shown in the flowsheet (Fig. 5) and in the accompanying tables and reproductions of photographs.

The primary flotation machines, as well as the others used throughout sections 1 and 2 of the new mill, and also the old mill, are all Southwestern-type pneumatic machines. They are of three sizes: four-cell roughers, 5.2 m. long, there being four such machines per section; five-cell cleaners, 8.3 m. long, there being four such per section; and three-cell finishers, 4.1 m. long, there being five such machines per section. Sections No. 3 and 4 have Fahrenwald machines, made in the Soviet Union and having an impeller diameter of 535 mm. and a cell cross-section of 950x950 mm. x 3,410 mm. high.

Tailings from the cleaner machines are sent to a Denver agitator, 2.4 m. in diameter, which serves as a distributor for the zinc section.

The final lead concentrate froth is sent to a 12-m. Dorr thickener, from which the underflow is carried in a small bucket elevator to Oliver filters, 2.438 m. in diameter by 3.067 m. face. The dried cake is dumped into wagons, which run on a short track to the main railway line, where it is loaded into box cars and sent around the other side of the hill to the smelter.

In the zinc flotation circuit the final zinc concentrate froth is sent over two Plat-O tables for final cleaning, and the control, and some excellent results have been obtained. An attempt has been made to produce tailings with not over 1.5 gram per ton gold, 0.08 per cent copper, 0.35 per cent lead, and 0.8 per cent zinc. This would be indicative of good practice at the Ridder mill, and there have been days when such results have actually been obtained, but such recoveries cannot be said to be constant.

One factor to be noted, and the effect of which every millman will appreciate, is the great variation in the types of ore, as shown in Table VI. If a mill is obliged to take everything which the mine produces, as the Ridder mill has to do, without bedding bins or any other means of mixing the ores, then, obviously, on that day when the material sent to the mill is mostly impregnated rock or slaty ore, the mill analyses will not be the same as when rich sulphide ore is sent to the mill. And such things happen in Ridder. The authors of this article have suggested two remedies for this situation. One would be to make charts from the geologists' data as to the metal content of each stope and another, to have some means of mixing or bedding the ore received, so that the mill could draw its daily supply of ore with an approximately uniform metal content. As it is, the mill superintendent and foremen have no knowledge of the ore they are putting through until the shift is over.

Reagents are added as follows: soda, cyanide, and zinc sulphate to the Marcy ball mill; copper sulphate to the Denver agitator feed launder; Aerofloat and xanthate are added in many places, to the Marcy mill for the lead circuit and then to the Denver agitator as well as at points further along in the sluiceways for the zinc circuit. Pine oil and terpineol are added to the flotation cells, and lime is added to the thickeners as a coagulator.

During 1935 an automatic sampler was built and placed in the tailing sluiceway, but it was mechanically imperfect and had to be discarded and hand sampling continued. Reagents were added by simple and crude devices until 1935, when automatic feeders of the Denver type were built in Ridder and put into operation on some of the reagent lines; however, these require considerable adjusting, so that the average consumption per ton as quoted in Table IX has a fairly wide set of limits.

In the beginning of 1934 the Marcy mill crushed the ore to 20-mesh size using balls of 60 to 75 mm. diameter and drawing current from a 450-volt line, this giving 4 to 5 tons crushed material per hour. At the end of 1934, the same mill was producing about 9

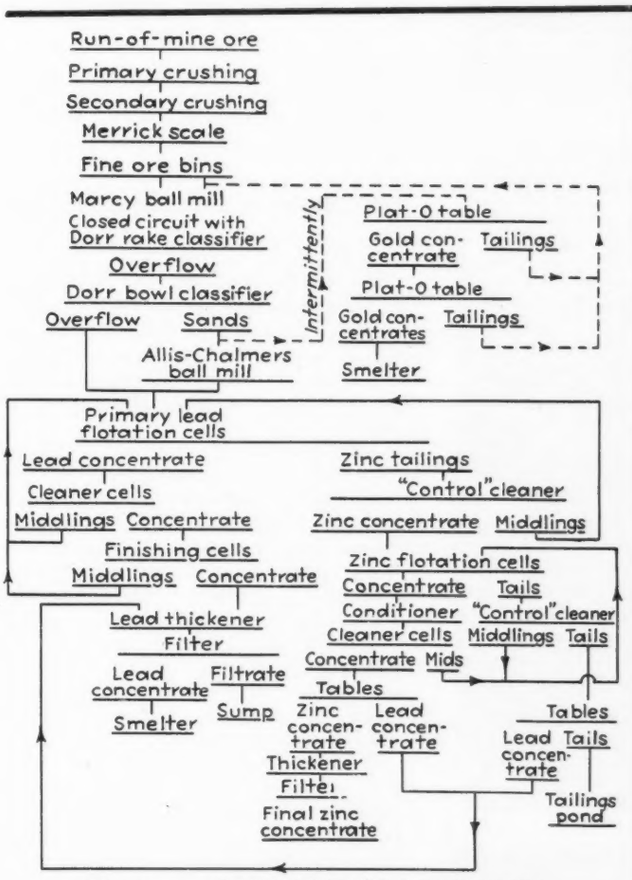


Fig. 5 . . . THE RIDDER MILL FLOWSHEET

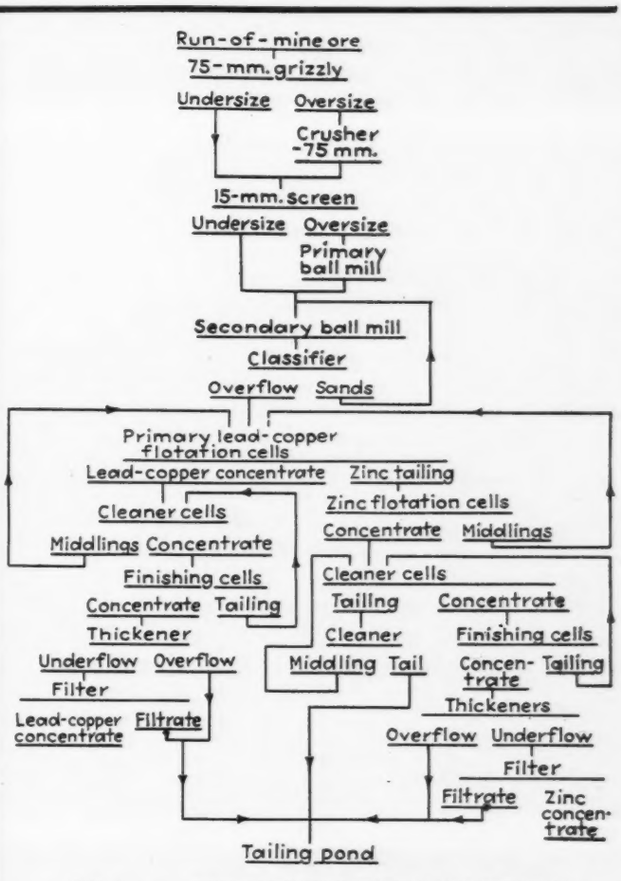
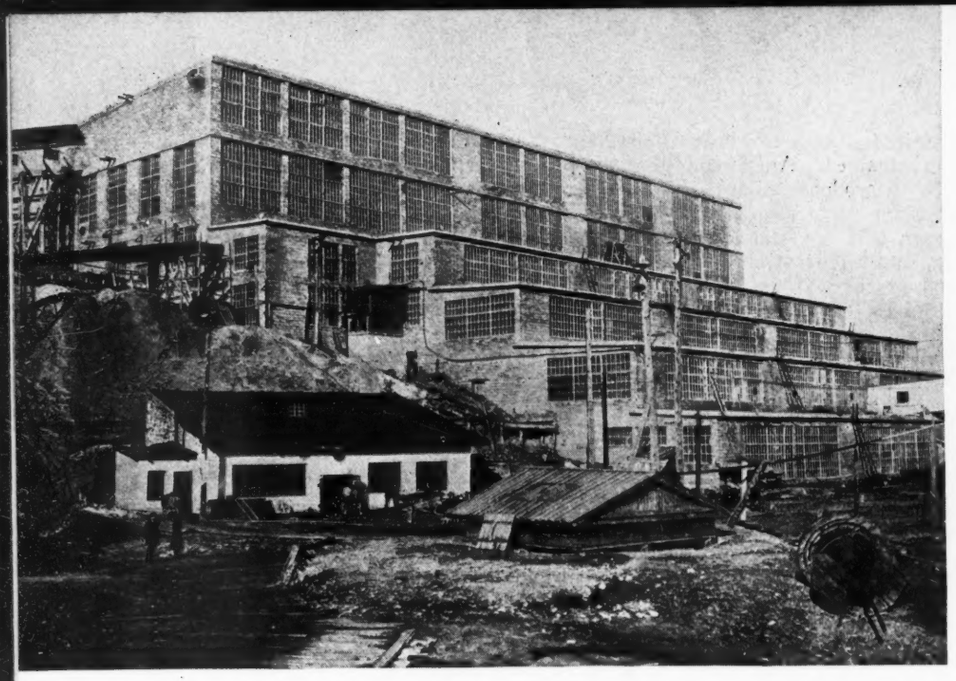


Fig. 6 . . . THE ZYRIANOVSK MILL FLOWSHEET

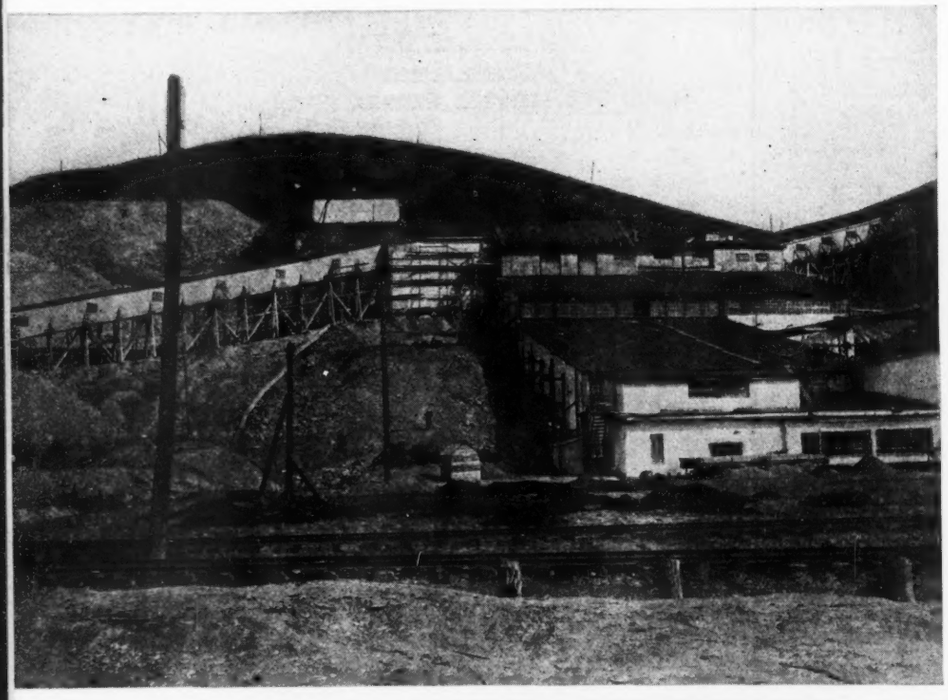
concentrate from these is sent to the zinc thickeners, from which the underflow goes by bucket elevator to a filter to be dewatered, this material forming the final product.

Intermediate products in the flotation circuits are subsequently treated in further flotation cells to recover additional values, and tables are used on all final products before sending them to thickening and filtration. The method of treatment is changed so often that it is not possible to describe any scheme as fixed for the Ridder mill at present.

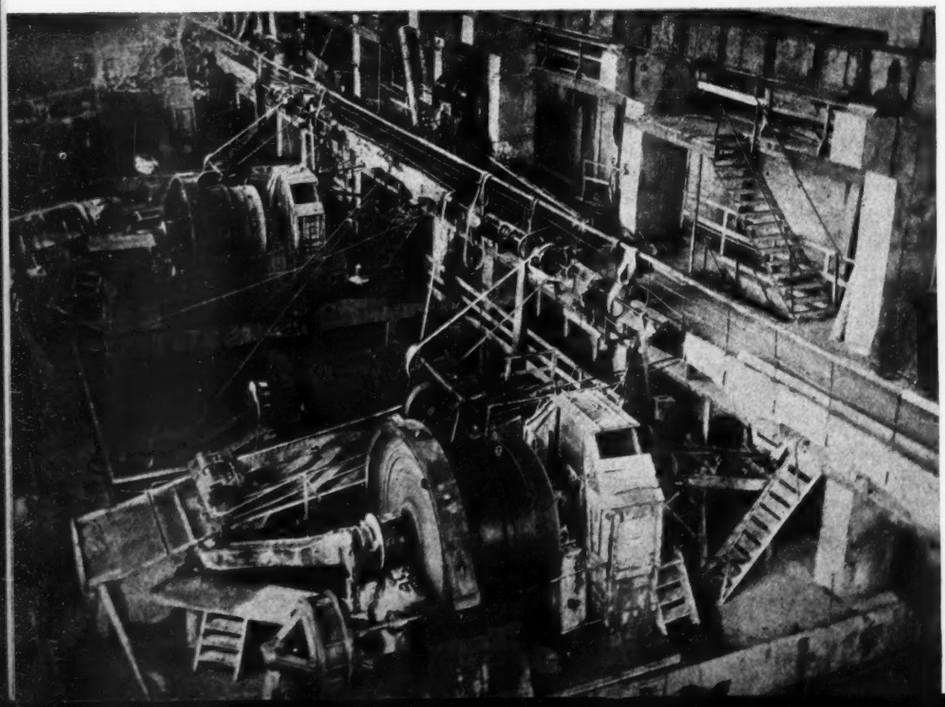
In the past few months a series of tests have been made with a view to increasing recovery of metals by closer



1... PLENTY OF DAYLIGHT
enters the numerous windows in the recently completed 1,000-ton mill at Ridder. The thickener and filter plant is at the right, connected to the mill via the inclosed runway. At the upper left is the housed conveyor running from the coarse-crushing plant. The small white building in the foreground is a warehouse and repair shop



2... PRE-SOVIET METALLURGY
was carried on in the old mill, which has been rehabilitated and in which some new equipment has been installed, which permits milling at the rate of 250 tons per day in this unit. The tracks in the foreground are the spur which brings concentrates to the smelter and joins the main line of the Ridder-Ust-Kamenogorsk Railway, recently connected with the Turk-Sib Railway, thereby affording direct communication with the major arteries of Soviet railway transport



3... FINE GRINDING SECTION
in the Ridder mill is equipped with ball mills using 3-in. and 5-in. balls. The rake classifiers are inclined at 15 degrees

tons of crushed material per hour, using balls of 100-mm. diameter and current from a 550-volt line. It is planned to use 125-mm. balls and 550-volt current to produce the desired 10 tons of crushed material per hour without reducing the quality of the product.

Mill capacity is rated at 230 tons of ore per 8-hour shift, based on the fine-grinding section, which would include both the Marcy and the Allis-Chalmers mills. This would be considering sections 1 and 2 in the new mill, and the old mill. It is planned that during this year and the next sections 3 and 4 of the new mill will be put into operation, handling in all 1,000 tons ore daily, and then the old mill will treat only impregnated and slaty ores and will serve in solving special problems.

In the Ridder mill today the motors and pumps used are derived from a number of sources; for example, the pumps used are as follows: 2-in. pumps—Soviet-made Wilfley-type pumps and five pumps imported with the Oliver filters; 3-in. pumps—44 Soviet-made and ten imported Wilfley units; 4-in. pumps—five Soviet-made and two imported Wilfley units; 6-in. pumps—one Soviet-made and two imported Wilfleys. As for motors there are, for example, two Siemens-Schuckert, one Westinghouse, and two Soviet-made motors on the bucket elevators from the thickeners to the filters (each 10 hp.) On the pneumatic flotation machines there is a single Siemens-Schuckert motor rated at 370 kw. Everywhere else the Soviet-made motors are replacing the imported machines as rapidly as necessary. Generally throughout the mill Tex-rope drives are used to connect the motors with machines.

One serious incident occurs each win-

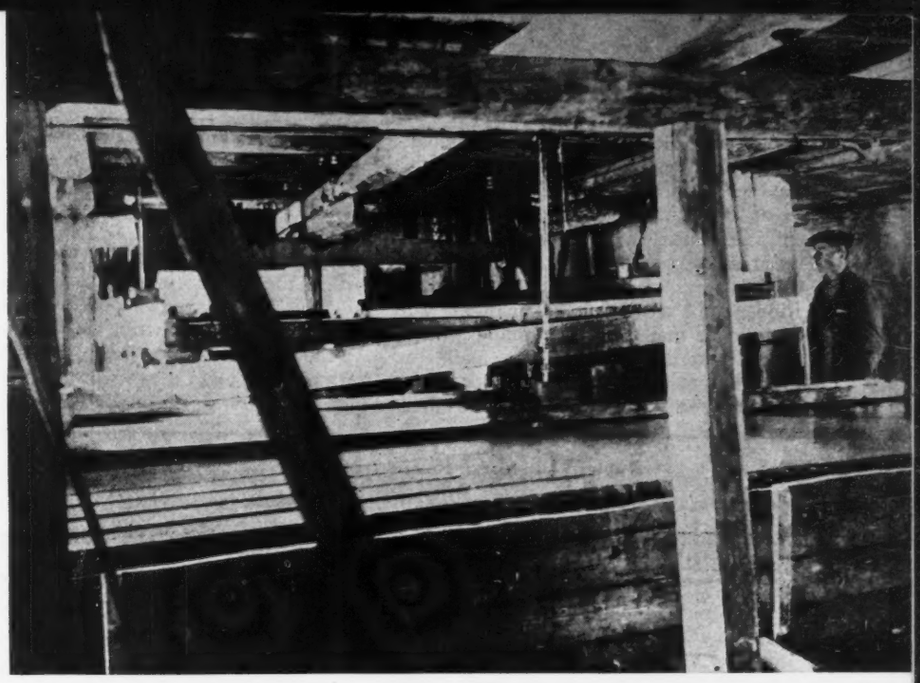
ter. With the coming of prolonged cold weather the lubrication throughout the mill freezes up and gives especial difficulty in the fine-grinding section.

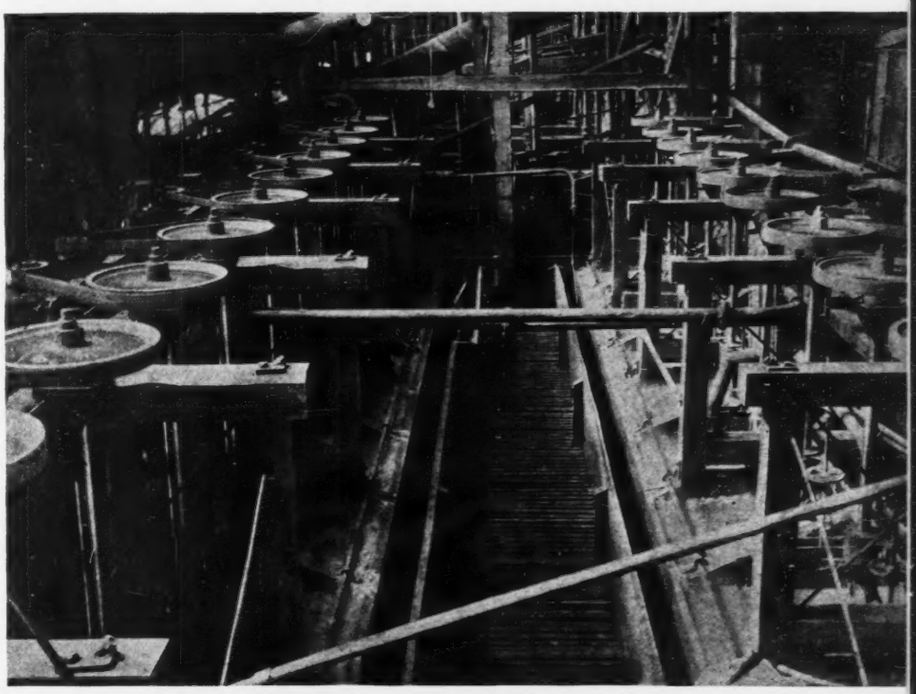
Employees in the mill total 371 to 467, about 60 per cent of whom are native Kazak laborers. The distribution is as follows: One mill superintendent with one technical supervisor and one materials supervisor, chief mechanic, chief electrician, old mill and new mill shift engineers, and shift bosses; coarse-grinding section, chief and boss of filter section. Then in each section the following are employed: coarse grinding, 14 to 17; conveyors, 6; fine grinding, 43 to 56; gold section, 5; flotation, 49 to 50; filter section, 13 to 15, helpers various (including loaders, muckers, electricians' helpers and mechanics' helpers), 174 to 200; engineers and technicians, 36 to 43; office, 10 to 11; scrubbing and cleaning help, 7; apprentices, 4 to 8. This is approximately the labor distribution. Applied to the month of September, 1935, when 21,667 tons of ore was handled, one calculates 46.5 to 58.5 tons of ore per person employed in the entire mill.

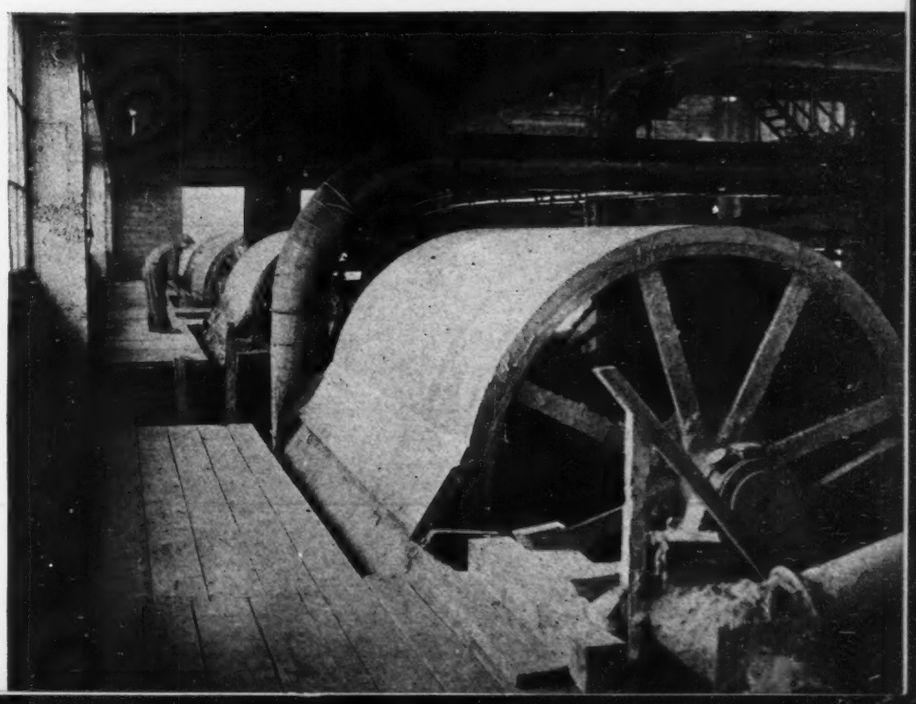
The tailings are run off to a tailing pond in a wooden pipe about a kilometer long. These tailings are often rich in metal, and simple devices such as a settling cone with tables and a trough with riffles are put into their path and additional recoveries are made.

Lead concentrates and concentrates from the tables in the gold section are run in box cars around the hill to the smelter. There are no storage bins, and the delivery is often irregular, subject to the weather. The zinc concentrates are disposed of in two ways: the greater part is shipped in box cars to either the electrolytic zinc works in Cheliabinsk or the Belovo smelter-retort works, and some of the zinc concentrates are roasted there in Ridder for making sulphuric acid.

In place of recovery percentages, the actual tonnages and contents are







4 . . . TAILINGS
often contain precious metals, which are saved in this case by treatment in cones, followed by vibrating tables, as shown herewith. Further recovery is made in troughs equipped with riffles. Hand-hewn timbers have been used in the construction of metallurgical plants, but in the more recently constructed mills structural steel and concrete are commonly found

5 . . . FLOTATION SECTION
of the Ridder mill. Here the V-belt type of drive is used. Some of this equipment has been imported and flotation machines of similar type are now manufactured in the Soviet Union

6 . . . CONCENTRATE IS DRIED
in the new mill on a battery of five drum-type filters. The cake drops into small cars, which transport it to the near-by smelter

given here for the month of September, 1935, which may be considered one of the best operating months. However, great fluctuation occurs from shift to shift and from worker to worker, and the results show this irregularity. To establish full technical control in the Ridder mill a number of changes will have to be made. Only recently was it possible to have screen tests made on the mill feed, and not oftener than once each shift; moreover, the chemical analyses made in the central laboratory are actually completed many hours after the shift has ended, and the samples taken for these are not always the most representative.

There is a possibility that some time within the next few years the Ridder mill will be enlarged in order to handle the increasing production of the mine. At the end of 1935 ground was broken for a cyanide plant to re-treat all the tailings dumps lying around. An average sample from these dumps gave the following analysis: Au, 10.8 grams per ton; Ag, 73.2 grams per ton; Cu, 0.39 per cent; Pb, 3.59; Zn, 10.5; S, 3.9; CaO, 2.62; Al_2O_3, 8.8; Fe_2O_3, 6.12; SiO_2, 53.5 per cent.

Results of a screen test of this average sample are as follows: plus-5 mesh, 5.7 per cent; plus-10 mesh, 4.8; plus 14 mesh, 3.7; plus-20 mesh, 1.6; plus-30 mesh, 3.0; plus-60 mesh, 8.7; plus-100 mesh, 14.9; plus-150 mesh, 11.6; plus-200 mesh, 12.2; minus-200 mesh, 32.4 per cent.

At Belousovsk only a small pilot mill is working on the ores of that region, to determine the proper scheme for concentrating the complex ore (note Table IV, pg. 350, July *E. & M. J.*). It is hoped to make a copper concentrate, a lead concentrate, a zinc concentrate, and possibly a pyrite concentrate.

Fig. 6 shows the Zyrianovsk mill flowsheet.

The Zyrianovsk mill began to operate in the summer of 1932. The mill is equipped throughout with Humboldt (German) machinery, except for some small details as the Wilfley sand pumps, of which there are seven 3-in. size, and two Dorr thickeners (10 m. diameter and 2.5 m. high). Production averages 230 to 250 tons of ore handled daily.

The coarse-crushing equipment consists of one Blake jaw crusher, 400 mm. x450 mm. crushing plates, handling 12 to 16 tons per hour and reducing the ore from 400 mm. to 75 mm. size. Crushed material is conveyed on a belt to a 1,200-ton capacity bin and from here it passes over a scale to a Humboldt cone crusher with 180 mm. opening and 18 mm. discharge. A magnetic separator is placed above the last roller on the conveyor. The material drops to a 250 tons' capacity bin, from where it feeds directly to the ball mills, two mills each 2.5 m. long and 2 m. in diameter. The product is reduced 65 per cent to pass 100-mesh screen. Each ball mill is connected in closed circuit with a double rake classifier, 12.5 m. long and 1.8 m. wide. Sands go back to the mill and fines overflow to the sump, from which material is pumped to an equalizing or distributing cone which feeds the flotation machines, of Mineral Separation type, there being three of fifteen cells each. Concentrates are sent to thickeners and thence to three American filters. The dry concentrate is shipped in burlap sacks containing 210 lb. of lead-copper concentrates. Zinc concentrate is shipped in 140-lb. sacks. All the lead-copper concentrate goes to the Ridder smelter, and the zinc concentrate is shipped to Belovo and Cheliabinsk zinc plants. Supplies and concentrates are shipped via the Irtysh River during the short summer months.

The Ridder and Zyrianovsk mills sometimes show good results and at other periods show poor results without any logical basis. Reagent consumption

(*Continued on page 476*)

Table VII—Metal Reserves of Altai, January, 1934

POLYMETALLIC ORE, Metric Tons	COPPER, Metric Tons	LEAD, Metric Tons	ZINC, Metric Tons	SILVER, Kg.	GOLD, Kg.
61,248,858	595,841	1,878,621	3,952,317	4,475,307	350,000

Table VIII—Average Analyses for the Period 1934-35

	GOLD, Grams per Ton	SILVER, Grams per Ton	COPPER, Per Cent	LEAD, Per Cent	ZINC, Per Cent	IRON, Per Cent
Ore	9–15	60–100	0.5–0.7	3.5–5	7.5–9.5	3.5–4.5
Zinc concentrate	20–24	150–225	1.0–1.7	4.5–7.5	42–45	6–10
Lead concentrate	85–100	400–800	2–4.5	34–46	12–18	6–10
Tailing	1.5–4.5	12–18	0.1–0.2	0.3–0.5	1–2.5	2.5–5

Table IX—Consumption of Reagents Per Metric Ton of Ore

	Average for 1934, Kg.	Sept. 1935, Kg.
Soda	1.99	2.0
Cyanide product (a)	0.44	0.273
Zinc sulphate	1.31	0.975
Copper sulphate	0.55	0.51
Ethyl xanthate	0.16	0.172
Pine oil (b)	0.07	0.058
		0.023
Aerofloat No. 25	....	0.079
Lime	....	0.09
Water, cu. m	....	9.3
Balls, kg	2.77	1.8

(a) Cyanide reagent in 1934 was the regular imported material, but in 1935 a domestic product was used which was of about 35 per cent strength in cyanide

(b) Pine oil in 1934 was the reagent normally made in the Soviet Union, but in the last quarter of 1935 use of an oil made in the Altai region from the local conifers was begun. Terpineol in small quantities has replaced pine oil.

Table X—Consumption of Electrical Energy September, 1935

Unit	Total Consumption, Kw.	Consumption per Ton Ore, Kw.
Coarse crushing	54,136	2.50
Conveyors	50,303	2.32
Fine grinding (including the Marcy and the Allis-Chalmers mills)	542,557	25.04
Flotation	150,227	6.93
Filter section	197,880	9.13
Tables in "Gold Section"	116,349	5.37
Totals	1,111,452	51.29

Table XII—Some Characteristics of the Zinc Circuit

Materials	Per Cent Solids	pH
Tailings from lead cleaner control cells	17.3	8.7
Feed to primary zinc cells	16.4	8.4
Tailings from primary zinc cells	16.1	7.6
Feed to zinc control cells	16.7	8.4
Tailings from zinc control cells	15.9	7.7
Tailings from cleaner cells	6.2	...
Feed to finishing cells	11.0	9.3
Tailings from finishing cells	3.4	8.6

Table XI—Composite Table Giving Characteristics of the Lead Flotation Circuit From Various Tests

Material	Solids	pH	Gold	Silver	NaCN	Zn	Cu	SiO_2
			Milligrams per Liter			Grams per Liter		
Pulp and bowl classifier—first section	10.6	8.5	40	260	7.5	4.0	9.1	8.8
Same from second section	18.2	9.6	40	660	15.0	7.1	47	14
Tailings from primary lead cells	16.7	8.5	40	420	10.0	4	4	62
Tailings from lead control cells	16.4	8.5	120	400	10.0	0.6	2	13
Tailings from lead cleaner cells	8.5	7.8	40	260	7.5	4.6	3	13
Tailings from first finisher	4.7	7.7	40	250	7.5	3.0	1	11
Tailings from second finisher	2.4	8.3	40	250	2.5	0.6	0.8	17
Combined middlings product	4.8	7.7	40	240	2.5	0.8	6	9

Table XIII—Metal Balance at Ridder, September, 1935

	GOLD	SILVER	COPPER	LEAD	ZINC	IRON
Ore, 21,667 tons	12 grams/ton 263.037 kg.	109 grams/ton 2,370.37 kg	0.52% 112 tons	4.14% 896.2 tons	8.29% 1,796.5 tons	3.6% 798.3 tons
Lead concentrate, 1,616 tons	103 grams/ton 166.814 kg.	804 grams/ton 1,299.85 kg.	4.54% 73.4 tons	41.68% 673.65 tons	15.52% 250.8 tons	9.4% 151.9 tons
Zinc concentrate, 2,579 tons	21.82 grams/ton 56.273 kg.	225.87 grams/ton 582.513 kg.	0.95% 24.5 tons	6.67% 172.0 tons	42.83% 1,104.57 tons	8.6% 222.3 tons
Concentrate from gold section, 21.364 tons.	661.3 grams/ton 14.127 kg.	651.1 grams/ton 13.911 kg.	0.95% 0.204 ton	23.4% 4.999 tons	14.44% 3.086 tons	15.6% 3.329 tons
Tailings, 17,450 tons	2.46 grams/ton 42.981 kg.	16.11 grams/ton 281.47 kg.	0.11% 19.219 tons	0.50% 87.359 tons	1.58% 276.0 tons	2.1% 351.1 tons

NEWS
OF THE INDUSTRY

Higher Taxes Expected on Philippine Gold Production

Assembly of the Island and President Quezon desire fair treatment for Mining Industry

THE end of the first half of 1936 found the mining industry of the Philippines in the most favorable position it has ever known. During the six months, $9,952,789 was produced from the fifteen mills serving lode mines, and about $175,000 from placer properties. This figure is a gain of more than $2,500,000 for the same period in 1935, or more than 35 per cent increase. Estimates made earlier in the year that 1936 would see $20,000,000 in gold shipped from the Islands have been found too conservative; mining leaders now place the 1936 figure at $22,500,000 or more.

✦ Public hearings are held several times weekly by the Philippine Assembly at which representatives of the mining industry discuss with the various committees suitable steps to be taken for the best interests of all concerned. Present indications are that taxes on gross output will be raised between 25 and 35 per cent, with allowances being made for these companies which handle low-grade ore; that a bureau of mines will be created; that there will be stricter supervision over promotional activities; that, in general, the Government will act to encourage legitimate mining development and the investment of outside capital in mining projects here. Complete harmony has prevailed at all discussions between legislators and mining men. President Manuel L. Quezon has made a number of public statements in which he has promised fair treatment to the industry, and mining men have expressed their confidence that the new legislation will not harm the industry.

✦ A drain tunnel, 9,000 ft. long, has been started in the Suyoc district by the Palidan-Suyoc Deep Tunnel Company, a subsidiary of the Marsman Interests. This tunnel will go from the Suyoc River to intersect the working of Suyoc Consolidated. It is expected that several companies will carry on development work from the tunnel. Suyoc Consolidated, after two years' work underground, has found that ore increased in value and quantity with depth. The drain tunnel will hit the Suyoc workings about 500 ft. lower than the present lowest level of that property. The new company is to share in the profits of all ore mined at Suyoc Consolidated after the drain tunnel is completed (in about two years), and will also share in whatever profits are realized from properties opened up along its length. Cost of the project will be about $300,000 and $75,000 has been allotted for development work. The authorized capital, $375,000, was oversubscribed as soon as it was offered.

PHILIPPINE GOLD PRODUCTION

	—First Six Months—	
	1936	1935
Antamok Goldfields	$1,063,820	$658,147
Bagulo Gold	267,741	221,945
Balatoc	3,125,415	2,992,856
Benguet Consolidated	2,298,408	1,935,980
Benguet Exploration	57,804	77,731
Cal Horr	213,942	none
Demonstration	386,338	209,374
Ipo Gold	157,904	139,882
Itogon	644,371	577,870
I. X. L.	278,289	98,086
Masbate Consolidated	387,448	160,141
Salacot	117,869	none
San Mauricio	434,518	none
Suyoc Consolidated	278,679	219,283
United Paracale	332,502	30,500
Total	$9,827,789	$7,321,804

✦ Operations at the Big Wedge 150-ton cyanide plant were started on July 1. Results to date have been satisfactory, although excessive copper in the ore from the Broadway vein has made it necessary to stop handling this ore while a suitable treatment is being worked out. Ore from other sections of the mine is being mined, and the mill has been in continuous operation.

✦ East Mindanao Mining Company started its new plant on Aug. 15. The work of construction, done by the Engineering Equipment & Supply Company at Manila, was carried out ahead of schedule. This will become the first lode property to go into production on the island of Mindanao.

✦ Mining of Gold Creek ore has been stopped, and an intensive development

(Continued on page 474)

CHROMITE ORE-BIN FOUNDATIONS are being prepared here by the Florannie Mining Company and the Benguet Consolidated in the Caramines Sur region of the Philippines. A contract is reported signed with the Union Carbide Company, of New York, for the entire output of the property. About 100,000 tons of high-grade chromite have been blocked out, and $2,000,000 is expected to be realized, due to the premium paid on ore over 48 per cent chrome. Shipments will begin soon.

THE COMANCHE GOLD DREDGING COMPANY is employing this 7½-cu.ft. dredge, which operates on the old Foster Ranch, on the north bank of the Mokelumne River. The company recently added 73 acres to its gold placer holdings

California

Rehabilitation Continues And Mill Capacities Increase

NEW HEADFRAME and ore bins erected at the Rising Sun—Molybdenum and tungsten mined near Mammoth Lakes

✦ Rehabilitation and development work is progressing satisfactorily at the Rising Sun mine, near Colfax, Placer County, recently acquired by the Rising Sun Mining Company, headed by Eastern interests. A new 60-ft. headframe with two 50-ton bins has been erected over the shaft, which is to be reconditioned and eventually sunk another 300 ft. prior to the extensive lateral work planned. The mine is credited with a yield of $2,000,000 in gold above a depth of 750 ft. and about 5,100 ft. of lateral development. Thomas N. Coan is superintendent.

✦ Carson Hill Gold Mining Corporation is installing additional equipment at its mill at Melones, and equipment in course of erection includes a 1,200-ton circular steel bin, 12x14-ft. Marcy mill with Dorr classifiers, at the mill proper, and seven 50-ft. leaching cyanide tanks at the adjoining cyanide plant. Extension of the mill building and erection of the ore bin have been completed, and the mill is expected to be treating from 1,200 to 1,500 tons of ore a day after Oct. 1. The work is supervised by John A. Burgess, general manager.

✦ Operations are reported to have been started on deposits of molybdenum and tungsten on Bloody Mountain near Mammoth Lakes, Mono County, optioned recently by Titanium Ferro Alloys Corporation, Niagara Falls, N. Y. Work is directed by Eugene Thomas.

✦ It is reported that Williams Bar Dredging Company, formed recently, will let a contract for the erection of a large gold placer dredge to operate on the Upper Yuba River. The new company has also taken over on a royalty basis the holdings of the Mammoth Gold Dredging Company, the Forbes Estate, and the Sam Gunning acreage. P. J. Williams, Marysville, is president of the company.

✦ Installation of an electric hoist and plant buildings as a preliminary to extensive underground development has been completed at the Davey mine, in Garden Valley, by the Dayton Consolidated Mines Company, the new owners. Activities underground at present will be centered on the 200-ft. level to contact the Black Oak and Davenport veins. Homer L. Gibson, of Silver City, Nev., is president of the company.

✦ According to a report from Sonora, plans are maturing for the installation of a flotation mill at the Confidence mine, 12 miles east of Sonora, by the Confidence Gold Mining Company, 111 Sutter St., San Francisco. Underground, development work is carried on in the south shaft on the 1,000-ft. level. About 30 men are employed under the direction of C. T. Eastman.

✦ Cal Oro Dredging Company has resumed operations on the LeMay property, near Yreka, after a temporary shutdown during which the Gardella dredge was moved to the new location. Operations are directed by Lawrence Gardella, of San Francisco, president of the company.

✦ Sulphur Products Company is shipping 50 tons of sulphur daily from its lease on the Mechling property, 65 miles from Zurich station near Big Pine, Inyo County, where the product is quarried from a deposit cropping to the surface and averaging 80 to 85 per cent sulphur. Installation of additional machinery is planned.

✦ California Osborn Mining Company, a subsidiary of California-Engels Mining Company, Cyril Stevenson, president, has placed in operation the 250-ton mill at its Belmont Osborn property, near Angels Camp. Capacity of the mill was increased by the installation of a large Hardinge ball mill and auxiliary equipment to take care of ore shipments expected from the Morning Star and Gold Hill mines, acquired by the company and now under active development.

✦ Work on the 200-ton flotation mill now under construction by the Virgilia Mining Corporation at its property near Virgilia, Plumas County, is expected to be completed soon. The plant is about 800 ft. from the shaft, and broken ore will be carried to the mill bin by an aërial tramway. The mine is opened by a 300-ft. shaft, with drifts on the 100 and 200 levels. Mined ore is stored at present pending completion of the mill. H. A. Cohen is in charge of operations.

✦ Sampling operations are in progress at the Eagle Shawmut mine, near Chinese Camp, operated by Los Angeles interests headed by George W. Clemson and H. G. Miller. About 2,000 ft. of open cuts are being completed by a ½-yd. shovel, and the 500-lb. samples taken at regular intervals are treated in rockers. Installation of a dragline and floating washing plant is planned if values prove sufficiently attractive.

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PHILIPPINES

Continued from page 473

campaign started by the Antamok Goldfields Mining Company, which has been handling Gold Creek ore in its mill for the past year. Though results so far this year at Gold Creek have been disappointing, it is hoped that new ore reserves will be developed.

✦ A pilot mill, with a capacity of from 16 to 18 tons a day, will soon be installed at the Cabit Mining Association in the newly opened Bicol region. As soon as tests determine the proper flowsheet, a mill for large-scale production will be installed, according to officials of the company. Another property in this region, the Bicol Gold Mining Company, has sent ore samples to the United States and to Germany for testing. Here too, a mill will be constructed as soon as the metallurgical treatment has been worked out.

✦ The milling capacity of the San Mauricio Mining Company will be in-

creased from 175 to 350 tons a day by the first of 1937, according to an announcement made early in August. Underground developments have been favorable, and a considerable body of high-grade ore has boosted the monthly production figure to about $82,500 in July.

✦ A new organization, the Philippine Geological Society, was formed in Manila on July 10. Its main purpose is the study of geology of the Islands and the dissemination of scientific knowledge regarding geological conditions. About 50 geologists and mining engineers have signified their intention of becoming charter members. Branches will be formed in Paracale, Baguio, and Masbate. Prof. H. Otley Beyer, of the University of the Philippines, originator of the idea, was elected temporary chairman of the society; J. M. Feliciano, temporary treasurer, and Ralph Keeler, temporary secretary.

✦ L. R. Nielson & Company, of Manila, has entered the mine-management field. Contracts have been secured for the management on a profit-sharing basis of the Paracale Gold Mining Company, the Paracale-Gumaus Consolidated Mining Company, and the Tinago Consolidated Mining, Inc. George T. Scholey, for six years chief engineer at Balatoc, heads the engineering staff of the company.

✦ Small shipments of chromite and manganese ore have been made to Europe by the Antique Consolidated Mines, in Iloilo. Chromite has been shipped to Italy, and the manganese will probably go to Germany.

●

Ropes Gold Mine Closed Pending Decision

✦ Calumet & Hecla Consolidated, which has closed its Ropes gold mine exploration in the Ishpeming district, Michigan, has made no decision as yet regarding its future policy at that property. Pumps will be operated, however, to keep the mine in good condition. A large tonnage of ore is indicated as the result of drilling and mine development. The ore, however, is said to be low grade.

✦ Calumet & Hecla continues to mine rich conglomerate copper rock from the upper levels, and will work out Nos. 2 and 4 shafts this year, leaving Nos. 6 and 7 as the only shafts operating on the Conglomerate lode. The Tamarack reclamation plant remains idle, but at the Lake Linden plant the richest available sands are yielding a high percentage of copper.

✦ The Copper Range company is sinking its shaft in Globe lands to develop the extension of the Baltic lode. The shaft will be sunk about 700 ft. and connection will be made with the 18th level drift from the Champion mine.

Nevada

A Larger Mill for Jumbo Mine Near Jungo

HIGH-GRADE GOLD ORE now treated in small plant—Interest in quicksilver prospects

✦ The Jumbo gold property in the old Awakening or Amos district, 36 miles northeast of Jungo station, in central Humboldt County, is attracting wide interest and has been visited lately by a number of scouts and engineers. It is reported that Ex-president Herbert Hoover visited the strike on one of his fishing trips and advised the owners not to sell the mine if it provides a good livelihood for their families. George and Jesse Austin, brothers, with the former's two sons, Kenneth and Wilbur, bought the claims in April, 1935, for $10,000, with $500 down payment and the balance paid in installments over a year. The Austins declare they have rejected offers up to $250,000 for the property. They have been producing up to $500 per day from the richest ore in a 2-ton Straub mill and are said to be planning early construction of a 25-ton mill. Reports say the four have formed a 50-year trust under which no part of an owner's equity may be sold.

✦ Staff members of the St. Joe Consolidated Mines Corporation are engaged in sampling and mapping geology of the Haywood-Santiago group of mines a mile west of Silver City and embracing the fissure system known as the Silver City fracture belt of the Comstock lode. A large reserve of good mill ore was indicated by earlier sampling and construction of a larger mill at the mine is in prospect if these results are verified.

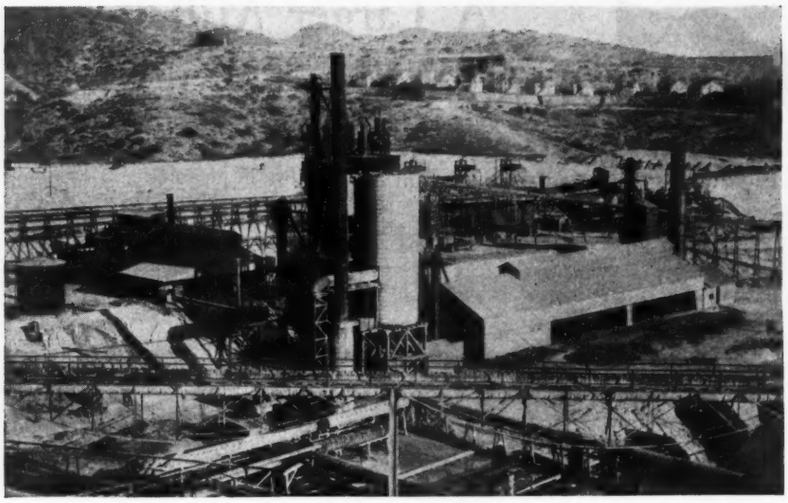
✦ An early increase in Nevada's output of tungsten, antimony, and quicksilver is foreshadowed by the widening quest for these substances and the opening of many prospects. Nevada-Massachusetts Company is the largest American producer of tungsten from its two mines and flotation mills, one near Mill City, in Pershing County, the other west of Mina, in Mineral County. Scheelite prospects in several other countries are being opened. The old Bray antimony mine, in southern Lander County, is shipping high-grade antimony ore to a Utah smelter.

✦ Following the recent increase in capacity of its amalgamation-flotation mill from 35 tons to 125 tons per day, the Overland Mines Company has purchased a number of patented claims adjoining its Overland mine, a mile north of Silver City, and is extending development drifts and crosscuts into newly acquired areas on levels down to the 600.

✦ Voluntary bankruptcy proceedings, instituted in New York by officers of the Como Mines Company have resulted in the appointment by the Federal district court at Carson City of Donald W. Atchison, of Reno, as receiver. A financial statement, following the closing down of the mine and mill, listed debts at $218,414.72 and assets $64,699.

✦ Ambassador Gold Mines, Ltd., has completed a 75-ton flotation mill at the Buckskin mine, recently purchased and situated 15 miles west of Mason, in Douglas County. A pipe line used in unsuccessful hydraulic placering by the company in Smith Valley has been relaid to supply the mill with water. The Ambassador company lately secured an option of purchase on the NRA gold property of the Scossa brothers at Happy Creek, Humboldt County. Horace Lackey, of Yerington, is manager.

✦ Six men lost their lives by accidental asphyxiation at the Mountain City Copper Company's mine of the International Smelting Company on Aug. 13, at Mountain City, Elko County, Nev. Two of them were caught in the winze between the 500 and the 600 level. Four more men lost their lives in a heroic but futile attempt to rescue their comrades. The dead were: John Shepperd, 32, Wellington, Colo.; William Burns, 48; Lawrence Willis, 32, Emmet, Idaho; June Barr, 45, Mammoth, Oregon; Albert Apel, 41; Frank Texeira, 44, Mountain City, Nev. A mine rescue team from the Tintic Standard Mining Company at Eureka, Utah, flew by airplane to the Elko County camp and assisted in the rescue work. The Tintic Standard men were John J. Hodges, Fred Fisher, Leonard Pitt, and Stanley Bliss. Matt Murphy, Nevada State mining inspector, and A. Tannahill, member of the State Industrial Commission, investigated the accident and reported they found the equipment at the Mountain City Copper mine in perfect condition and adequate for the emergency. They said there were enough oxygen helmets and a sufficient supply of oxygen for a rescue crew. The workmen who entered the gas-filled area did so without the permission of any mining official. Evidently, the deaths resulted from carbon monoxide poisoning. Testimony at the coroner's inquest indicated that Barr and Willis were lowered into the winze by Apel, the pumpman. Seeing their plight, Apel is believed to have climbed down to rescue them and died. Teixera, relief pumpman, then lowered Burns and Sheppard in a bucket. After reporting their condition by telephone to officials on the surface, Texeira is believed to have died trying to save the last two rescuers.



MIAMI COPPER COMPANY'S new leaching and flotation plant used for the treating of oxidized copper ores

Arizona

Arizona Copper Miners Receive Wage Increase

MAJOR PRODUCERS grant a 5 per cent raise—Humboldt Mines, on Big Bug Creek, start operations of new plant.

✦ Four of the largest copper companies in the state increased wages 5 per cent on Sept. 1. The men affected number about 2,500 and are employed among the Copper Queen Branch of Phelps-Dodge; the Shattuck-Denn, of Bisbee; the Miami Copper Company, of Miami, and the Inspiration Copper Company. The average increase amounts to about 25c. per day.

✦ President M. L. Snapp, of Humboldt Mines, Inc., announces that a new 200-ton flotation plant will be placed in operation during the first part of September, on its Vulture and Red Rock properties, on Big Bug Creek near Humboldt. The power line from Poland Junction is now completed to the mill. Ores for several years' operations are said to be available.

✦ The Congress Mining Corporation early this year acquired the old Congress mine, at Congress Junction. The property consists of fifteen patented claims and some machinery. The corporation is seeking a $140,000 loan from the Reconstruction Finance Corporation so that mine may be operated upon a large scale. Gerald Sherman, of Brooklyn, N. Y., is consulting engineer to the company.

✦ Equipment and machinery have been ordered to increase the capacity of the plant of the Bagdad Copper Company to 500 tons a day. J. W. Still, in charge of operations, states that the mill will be ready about Dec. 1. Tentative plans are to increase the daily capacity to 1,500 tons during the coming year. New diesel engines may be installed, or connection with the main power line at Kirkland will be made for extra electrical energy.

✦ The Idaho Consolidated Mines Company, operating the old Leviathan mine, near Congress Junction, is planning the installation of a small amalgamation and flotation plant within the next 60 days. W. O. Woodbury is vice-president and general manager.

✦ The Ventura mine, 10 miles west of Patagonia, is stepping its mill up to 35 tons per day. Since June it has been shipping 25 tons daily to the El Paso smelter. Some of the ore assays as high as 40 per cent copper, although the principal metals are silver and gold. The property is operated by the La Ventura syndicate, which is financed by New York capital.

✦ The Hillside Mine, property of the Hillside Mines, Inc., George W. Prince, superintendent, is shipping, according to present records, 4,500 tons of gold and silver ore per month. Eighty men are employed.

✦ The Lyons mine, in the Squaw Peak district, near Camp Verde, is actively developing fourteen claims bearing gold and silver values. James McCall is superintendent.

✦ The Tombstone Development Company reports the finding of a body of $25 ore on the 400 level of the Empire shaft. The new find lies north of the Empire shaft in the direction of the Toughnut shaft, through which the United States Smelting, Refining & Mining Company is exploring some of the Tombstone Development Company's claims that it holds under lease.

✦ The 100-ton flotation mill of the Veta Mines, Inc., out from Duncan, will soon be ready to treat the ores from the Ash Peak and the Ash Peak Extension mines. The Shamrock, Commerce, and Hardy shafts have all been reconditioned.

✦ A new 50-ton mill is to be constructed on the Silver Bell mining properties 22 miles northeast of Florence. Glenville A. Collins, of the Collins Pacific Coast Mining Company, San Francisco, is making the final arrangements for the installation.

✦ The King of Arizona mine, near Yuma, is being rehabilitated and 400 ft. of drifting on the 200 level has been done since development started. The work is being done by the Dayton Consolidated Mines Company, of Virginia City, Nev., with Augustus J. Klamt, consulting geologist, directing the work. C. D. Harris is locally in charge.

✦ The new mill at the Bi-Metal mine, 3 miles south of Kingman, has been operating steadily for the past two months. The property is stated to have ore reserves in sight sufficient for three years' operation. Development, however, is said to be increasing the figure. This property shipped to the Tom Reed mill, at Oatman, for a year previous to installing its own plant. Claud Wilkinson, S. S. Jones, and Cy. Weeks are operating the property under option and lease.

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Metalliferous Altai

(*Continued from page 472*)

is approximately the same in both mills, and products also; if anything there has been at Zyrianovsk mill slightly better results than at the Ridder mill, but with the change of personnel inevitable, there is no assurance that the results will not change also.

Some unusual features about the Zyrianovsk mill are, first, the distinct problem of recovering the precious metals from the large quantity of wood chips which come from the mine and get thrown out of the circuit from the ball mills. Under the authors' suggestion this problem was successfully solved. Another, is the removing of the precious metals (free metallics) from the circuit by the use of short sluices between the ball mills and the classifiers. This perhaps is not the most effective way, but actually was a saving device of considerable importance in Zyrianovsk practice.

(*To be concluded*)

NEWS FROM WASHINGTON

By Special Correspondent

OFFICIAL Washington spent most of the summer, and is continuing in September, on an effort to interpret what Congress meant by June legislation. Naturally it is freely charged that the interpretations are often political. But this charge, even if true, is not fundamentally important to mining. It is vastly more important to find out what ultimately the career officials and the courts are going to say about administration.

The blizzard of Treasury decisions and explanations regarding new taxes is perhaps most immediately of concern. The "simplification" and explanation of the way in which to calculate corporation taxes requires many closely typed or finely printed pages. Detailed studies by lawyers and accountants of companies will be important. But the broad indication of official action is no different now than was expected when Congress decided last June that undistributed earnings would be taxed more heavily than those promptly disbursed as dividends.

Impartial observers in Washington agree that the result will be more rapid disbursement of earnings by those companies which can afford it. Those which cannot afford to disburse, because they need new working capital or must retire present debts, will simply pay the penalty in higher tax burdens, Washington generally agrees.

No New Taxes?

Many political motives are charged against the President, Secretary Morgenthau, and Congressional committee heads Senator Harrison and Representative Doughton for the recent much-headlined conference at the White House, after which came the announcement that no new taxes are expected next winter. No outsider denies that the major motive was politics.

Careful reading of the Secretary of the Treasury's letter shows plenty of loopholes through which to drive new tax legislation when wanted. Also, it is notable that no forecast was made concerning the probability of an early budget balancing.

Morgenthau could undoubtedly justify, on either of two grounds, his letter, which seemed to tell the President that no new taxes would be needed. He could have assumed, but probably didn't, that spending for relief, for made-work, and like emergency purposes will be curtailed by several billions. More likely he assumed that by continuing of borrowings and use of Social Security Law income, beginning in January, there will be easy money available to the Treasury. Such borrowings mean a continued increase in Treasury obligations, but not new security flotations of comparable size.

No mining executive is being wisely advised to make fiscal plans for his own enterprise on the assumption of lower Federal taxes. Uncle Sam's takings from industry's gross income will increase, not decline.

Drought and Mining

● Will the drought affect mining? This question cannot be answered by Washington with any degree of assurance. But there are indications that an all-knowing economist would probably say "In some measure, yes."

The drought is rapidly increasing the cost of food. This affects the distribution of wage earners' income—the grocer getting more and other folks less. This somewhat reduces optional spending power for housing, new autos, and other big consumers' capital goods which use minerals and metals in their making.

It looks as though increased business activity during the coming year will increase wage-earner payrolls enough to offset the increased cost of food. This means that the drought slightly defers new consumption of mineral products, but does not destroy present activity.

Government Economy

Three not altogether harmonious investigations of possible reorganization and economy in the Federal Government are under way. The Senate passed a resolution some months ago under which a special committee headed by Senator Harry F. Byrd, of Virginia, was to conduct a study and make recommendations to the next Congress. The President, apparently seeking to keep closely in touch with so fundamental a matter, also named a special committee; and he asked the House of Representatives to designate its special agency for a like purpose. Cooperation between the three groups thus far is limited to the appointing of Brookings Institution as a fact-finding agency to gather information on functions, relationships, and possibly on overlapping of activity.

The fact that Senator Byrd takes this matter seriously and apparently intends to make it a major part of his legislative effort next year gives some encouragement to those who would like to see a thorough job carried out. However, no large percentage change in total expenditures can result from activities of this sort.

The only opportunities for major economy lie in the fields of political significance. Decisions there will not rest on recommendations of any such committees, no matter how significant the findings or meritorious the recommendations. All the changes which experienced Washington observers imagine could possibly be accomplished in the old-line activities of the Government are small by comparison with disbursements for work relief and other so-called "emergency" purposes. The magnitude of those disbursements depends on the philosophy of the administration in power, and not on any question of duplication of activities or efficiency of career managers.

New Manganese Method

Publication of the new method for electrolytic production of metallic manganese developed by the Bureau of Mines (see *E.&M.J.* July, p. 357) has been delayed. It is desired that a patent on the new method be taken by the inventor, F. K. Shelton, before the details of the development are released. The War Department has requested this action in order that the Government be protected in shop rights in the event that commercialization occurs for production desired by Uncle Sam.

Under present varied Government practice, Mr. Shelton might have right of commercialization of his invention if a patent is granted, subject only to the Government shop rights which it is sought to establish in the course of patent procedure. It is hoped that the legal details involved will be worked out so that a description of the method may soon be released.

Some misunderstanding of the original publication has occurred. The Bureau points out that there has been no claim of ability to make manganese at $10 per ton. This figure was used in the original publicity to describe the estimated power cost at Boulder if the anticipated efficiency of production should be achieved. To realize a power cost of $10 would necessitate an efficiency equal to 60 per cent of the theoretical electro-chemical yield and power charged at about 1.5 mills per kilowatt-hour. There would, of course, be

added to this power cost all costs for ore, for leaching, and other expense incident to preparing the electrolytic solutions, labor, capital charges, and numerous incidental items.

Regardless of the important economic possibilities of the new method, the Bureau intends to carry forward the needed semi-works-scale studies to explore all technical features of the process. Some of this work has already started at the Reno station. It will be continued on a larger scale as soon as the new Boulder City laboratory of the Bureau is ready for operation.

Government officials emphasize the fact that any new method such as this is important to the Government regardless of immediate economic prospect. Such a method will, it is hoped, widen the reserves of available manganese and make American dependence on imported supplies less serious in case of military or other emergency affecting import.

La Follette Inquiry

Mining executives will watch with interest, and perhaps concern, the hearings to be held this fall by the La Follette subcommittee of the Senate. This group is to investigate alleged interference with free speech and restraint of collective bargaining rights. The first effort is to determine to what extent strike breakers or special strike police have been used.

Five important detective agencies, supposed to have been hired by mining and other interests for special strike-breaking service, have been subpoenaed. The contracts and office records of these concerns are being studied by investigators for the committee, and executives of each agency will be required to testify when the hearings open the latter part of September.

The resolution of the Senate which instructed the Committee on Education and Labor to make this study seeks to establish a basis for legislation restraining interstate movement of strike-breakers. The original committee consisted of La Follette, of Wisconsin; Thomas, of Utah; and Murphy, of Iowa. The death of the last-named Senator has created a vacancy to be filled by Senator Black, chairman of the committee. The successor to Murphy had not been named late in August, as this was written. The chief investigator of the committee is Robert Wohlforth.

Patman Panic

Some industrial executives give evidence to Washington of a panicky attitude toward the new laws which limit pricing policy. Old price schedules are undoubtedly due for an overhauling. Some significant changes in competitive relations will unquestionably follow in the mineral industry. But fundamentally a management still has the right to select its own customers and to determine, according to its own best judgment, the margin of profit which has optimum advantage for it.

Furthermore, the courts will undoubtedly protect any management against unreasonable applications of the law. Any management that bases its price structure on an honest effort to interpret costs, will at most, in the long run, suffer criticism. There is no danger that anyone will go to jail, or that courts will allow penalties to stick, even though subsequent pricing changes may perhaps be ordered. Impartial Washington thinks that business jitters are not justified, even though some radical changes in policy *are* necessary.

The Federal Trade Commission, which will administer the law, implies that it will proceed under this new form of the Clayton Act just as it has in administering the earlier Section 2. It does not intend to issue regulations or rules for the guidance of industry. It will investigate complaints, but presumably first by consultation with the concern complained of. There is no reason to expect shotgun attack on industry. The rifle shots will carefully be centered on firms most flagrantly violating the spirit of the law.

Rapid and complete administration is obviously impossible. Managements suspected of soldiering, in the hope that they will escape because of limited Federal funds and officers, are likely to be selected as the first targets for official fire.

One Washington observer summarizes the situation by saying the Patman Law is another good reason for believing that "honesty is the best policy."

Cadmium Prices

● Cadmium is priced differently for platers and for alloy makers. This is typical of the pricing practice in many other industrial lines, though probably not common in the metal industries.

What will the Patman Law do to such a pricing plan? This is an uncertainty all too typical of the situation faced by metal and mineral marketers generally. However, the wide variation in cadmium prices has a solid foundation, producers say, because the plating branch of the business is rather involved and tied up with patents for using a process that employs special shapes. Consequently, the sellers who supply these special shapes to platers, mostly in small lots, believe that they are justly entitled to a premium. The lower prices prevailing for cadmium obtain on large quantities and there is no price discrimination on this kind of business, it is claimed.

Labor Schism

Mining executives have had too much contact with the aggressive younger industrial-union leadership to express any surprise in Washington that Lewis and his faction appear decidedly the victors when "suspended" from A. F. of L. The Committee for Industrial Organization may or may not become a new "Federation." But Washington does not have a moment's doubt that it will be a more important factor in influencing further unionization of the mining industry than any type of craft leadership.

The break between A. F. of L. and C. I. O. in some measure is politically important, but much less so than many news interpreters imply. It probably releases certain normally conservative individuals from any sense of obligation to vote blindly for New Deal candidates. But no one ever "delivered" the labor vote. And careful political forecasters did not expect anybody to do so this year.

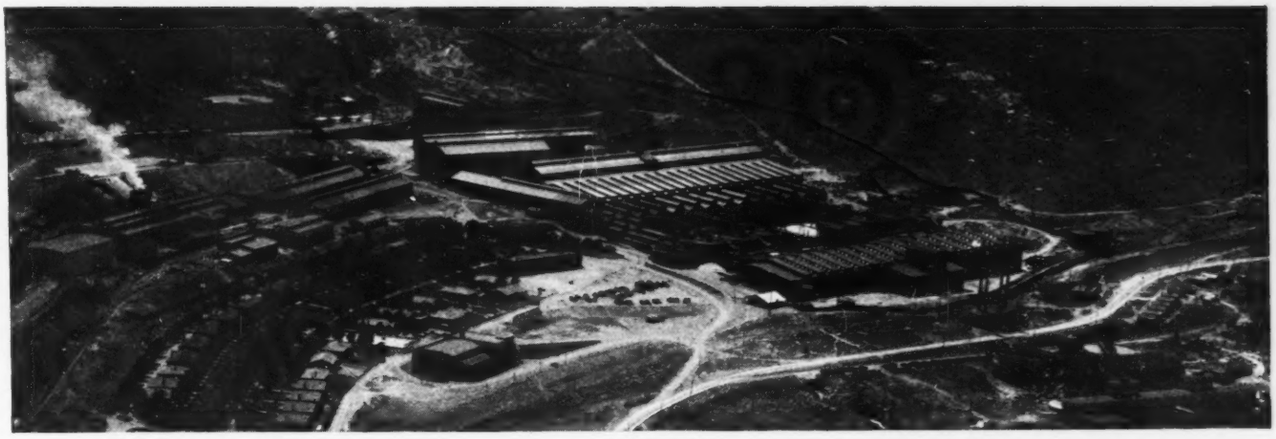
The slight readjustment resulting from the open break between Green and Lewis factions gives some comfort to Landon leaders; but nothing like the tremendous mental anguish to Mr. Farley that Republican well-wishers have publicly claimed. The Union party, Lemke-led, Coughlin-supported, is a much more significant factor in the campaign.

Stream Pollution

The failure of legislation on stream pollution at the last Congress was the result of two conflicting philosophies. One group of legislators wishes to have the Public Health Service put in charge of such new regulations as may be necessary to protect public water supplies and public health. Another group, enamored of New Deal philosophy, wishes to put the National Resources Committee in charge. The two bills which passed in the Senate and the House differed in this fundamental particular, and no reconciliation was accomplished before the end of the session (see *E.&M.J.* July, p. 359).

The mining industry will be much concerned with such legislation if it extends to the control of débris and tailings or slimes discharged into streams. In the West these wastes have commonly been the cause of controversy between mining operators and irrigation authorities or land-owners.

The discharge of chemicals and other causes of stream pollution are more commonly experienced in the East. For example, great emphasis is being given in Connecticut to means for controlling brass-plant wastes containing copper and zinc. These are the kind of discharges more actively under consideration in Congress, occasioning concern on the part of many process industries, as well as mining and metallurgy.



THE ARTHUR MILL of the Utah Copper Company, near Garfield, was reopened on Sept. 1, following a six and one-half year shutdown. The mill is about one mile from Garfield, and the Magna mill, which has been in constant operation, lies about one mile to the left. Ore from the huge surface workings in Bingham Canyon is hauled by electric-driven locomotives to the two plants.

Utah

Utah Copper Reopens Arthur Mill

HIGHER WAGES for workers and more men employed

✦ On Sept. 1 the Arthur mill, at Garfield, started operation for the first time since its shutdown on Jan. 25, 1930. Operations will be at one-third capacity of the plant. The Magna mill, also at Garfield, has been in constant operation, and during the latter months of 1935 the Arthur plant was reconditioned. Wages at the mine and mills will be increased 5 per cent, affecting 2,300 men. About 250 men will be added to the present payroll. Production capacity is now up to 60 per cent.

✦ The American Smelting & Refining Company increased wages of about 1,000 employees at the Murray and Garfield smelters, 5 per cent on Sept. 1. The company is planning to spend a large sum of money in improvements and additions to the Garfield plant. W. J. O'Connor is general manager.

✦ Ore running 30 oz. of silver to the ton, $3 in gold, 3 per cent lead, and 6 per cent zinc has been opened on the 950 level of the Park City Consolidated Mines plant, according to the report of W. R. Wade, president. Width of the ore has averaged from 4 to 10 ft. On the 900 level, ore of lower grade, and at times 35 ft. wide, was followed in the same fissure for a distance of 1,000 ft. The company is sinking a three-compartment winze from the 900 to the 1,200 level.

✦ At the New Park Mining Company property, at Park City, W. H. H. Cranmer, manager, reports that a body of ore carrying $32 a ton in silver, lead, and zinc, including $5.60 in gold, has been found in the Park Galena mine. The ore, in diorite, contacts quartzite and limestone. A drift from the Park Galena shaft is being advanced to reach the ore in depth.

✦ The Ontario Silver Mining Company passed out of existence in August when O. N. Friendly, vice-president and general manager, announced it had been marged with the Park Utah Consolidated Mining Company. The Park Utah company owned 98.8 per cent of the Ontario stock. The Ontario, opened in 1872, was sold by the discoverers to the late Senator George Hearst, of San Francisco, father of William Randolph Hearst, for $27,000. In all, the company paid about $15,000,000 in dividends.

✦ Kentucky-Utah Mining Company has awarded a contract to George L. Rist and P. L. Houston for driving its main tunnel in Big Cottonwood Canyon, 25 miles southeast of Salt Lake City, for a distance of 1,500 ft. to the south. The tunnel is now 5,000 ft. long, and the company plans to drive under the old Woodlawn mine to open up a high-grade ore showing in the old winze. E. L. Jeremy, of Salt Lake City, is president of the company.

✦ Leasers in the Zuma mine, Eureka, —R. E. Ferguson and Bernard Fennell—are reported to have opened up ore on the 700 level carrying values as high as $300 a ton. As broken down for shipment, it is reported to carry $30 a ton in silver, lead, and gold. Opened up for a distance of 20 ft., the ore is said to average 7 ft. wide. One shipment has been made and more are probable.

✦ The Chief Consolidated Mining Company, through Walter Fitch, Sr., president, announces that work is being carried on in the Chief No. 1 and the Plutus mines, which have supplied all of the company's profits, to find the extension of the two mines' great orebodies. Exploration is being carried on in the Apex Standard through the two shafts to find the extension of the North Lily and Tintic Standard mines orebodies in virgin ground.

✦ The United States Smelting, Refining & Mining Company has taken a lease on the Utah Metal & Tunnel Company's property at Bingham, adjoining the U. S. mine. The lease is for a 20-year period and provides for a 50-50 division of the net profits after deducting costs. Some time ago, the American Smelting & Refining Company relinquished a lease on the lower levels of the Utah Metal and Tunnel ground after spending about $200,000. United States Smelting officials had no plans of development to announce, stating that an inventory and legal details must first be completed.

✦ The United States Smelting, Refining & Mining Company has installed a transformer and an electric locomotive, and erected buildings to house its surface plant at the mouth of the Star of Utah tunnel on the New Park Mining Company's ground. Drifting southward 2,200 from the portal, the objective is to reach the Lookout Mountain and Hardup groups, which the company acquired last year.

✦ Silver King Coalition Mines Company, at Park City, reports for the quarter ended June 30, 1936, a net profit of $205,247.91 after all taxes and depreciation but before depletion. The company stored during the quarter a total of 663 tons of lead concentrate and 374 tons of zinc concentrate, valued at cost. Valuing the stored products at market instead of cost would have increased net income to $216,473.95, or 17.7c. a share. The quarterly profit amounts to 16.8c. a share on the 1,220,467 shares of par value of $5.

Colorado

All Mining Districts Active

CLIMAX MOLYBDENUM determining ore extensions—Blue Bird mine, in Cripple Creek, will sink a shaft to drainage tunnel

✦ An extensive exploration program is being followed by the Climax Molybdenum Company at Climax. Six diamond drills are working sixteen hours daily. This new work is being done to determine ore extensions below the Philipson level. The company has not yet fully explored the mineralized area, as sufficient ore is already blocked for present requirements.

✦ Cresson mine has installed a new air lift and has unwatered the mine to the eighteenth level, where recent development discloses good ore. The drainage tunnel is 125 ft. above the eighteenth level. Cresson is shipping approximately 9,000 tons of ore monthly.

✦ The South Burns shaft has a new headframe, ore bins, office building, and change room, and is now producing one car of ore per day. A new compressor has been installed and modern mine equipment purchased. The New Zealand and Mary Ann companies operate through the Burns shaft.

✦ The Portland properties of the United Gold Mines are now being operated by leasers. Between three and four thousand tons of ore per month are shipped. M. H. Salisbury is superintendent.

✦ The Ajax mine, which adjoins the Portland property, has been sunk 250 ft. below the 2,100-ft. level, where a crosscut intersected two veins containing rich ore. The Bobtail vein comes directly under the shaft, and to avoid excessive water flow, Superintendent Clayton Kissel offsetted from the main shaft and sank through the granite. This operation is below the drainage tunnel, which unwaters the Cripple Creek district. The company plans to sink 500 ft. and develop lower levels in the district.

✦ The Vindicator mine has connected the 2,100-ft. level with the drainage tunnel, by means of a 60-ft. raise. Good ore is reported on this level.

✦ The Abe Lincoln has been sunk 200 ft. below the eighth level, and a station is now being cut. Drifts will be driven each way on the vein, further developing the mine.

✦ The Johnny Logan mine has developed another flat vein on the eighth level, said to be richer than the flat worked during the past two years. Fifty tons daily are expected from the new deposit. Operations continue on two oreshoots on the upper levels.

✦ A loan of $20,000 to the Cross Gold Mining Corporation, of Boulder County, has been announced by the Reconstruction Finance Corporation. George Teal is president of the company.

✦ Blue Moxie Company, operating the Blue Bird mine, in the Cripple Creek district, is working two shifts. The day shift is mining above the tenth level, while the night shift is retimbering the shaft. The shaft will be sunk from the 1,700-ft. level, so as to reach the drainage tunnel, thereby unwatering the lower levels and permitting deeper development. Jack Sharp is superintendent.

✦ The Ada Bell mine has had its shaft deepened 250 ft. to the 550-ft. level. Laterals will now be driven to develop the orebody found on the 300-ft. level.

✦ The Molly Kathleen shaft is being sunk 500 ft. to the 1,000-ft. level, where a crosscut to the Black Diamond vein will be driven. Drifting along this vein for 1,380 ft. will reach a point under the Sangre De Cristo winze. When the work is completed it will permit mining and development of several properties through the Molly Kathleen shaft.

✦ The American Eagle mine is reported to have opened a good orebody between the 1,900 and 2,100-ft. levels.

✦ Eighty-one cars of ore were shipped from the Blackhawk district during July, compared to 84 cars in June. These cars contained ore from 30 operating properties, which indicates the active mining going on in this small section.

✦ Russel P. Reynolds, manager of the American Smelting & Refining Company, is in charge of new operations at the Iowa Tiger mine, 4 miles up Arastra Gulch from Silverton. This company is also operating the Silver Lake mine, near the Iowa Tiger mine. The two properties cover two hundred claims.

✦ The Golden Cycle mill, at Colorado Springs, Colo., treated over 50,000 tons of ore during July. The new Cripple Creek Milling Company continues operating at a good capacity. Improvements in some sections of the mill have recently been made.

American Mining Congress Convenes in Denver

✦ Denver will be the center of attraction for metal-mining men this month. The Western Division of the American Mining Congress will hold its annual meeting in that city, Sept. 28 to Oct. 3. In addition to a program of papers dealing with matters of vital interest to the mining industry, there will be an exhibit by more than 40 manufacturers of mining and milling machinery. All sessions, as well as the exhibit, will be held in Denver's Civic Auditorium. The meeting will celebrate the organization of the American Mining Congress in Denver in 1897, and will afford an opportunity to pay a timely tribute to J. F. Callbreath, who served as secretary from 1905 to 1934 and who for several years maintained Congress headquarters in Denver before removal to Washington.

The program will be devoted mainly to matters of economic and legislative importance in the mining industry. One entire session will be devoted to taxation. Several papers will be presented on the subject of rock dust in mines, its effect on miners' health, and its prevention. A special conference is being arranged on government and industry, with special reference to mining.

Entertainment features include the annual dinner—speechless variety—moonlight at Red Rocks, rock-drilling contest, and a testimonial luncheon to Mr. Callbreath. The Colorado committee will arrange trips to the mining districts on the last two days of the week. The meeting will be the first to be held in Denver since 1927, and is expected to be the largest and most successful held by the Western Division. Stanly A. Easton, president, Bunker Hill & Sullivan Mining & Concentrating Company, is chairman of the program committee. Jesse F. McDonald, prominent in Colorado mining, is chairman of the Western Division.

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Lalor Foundation Offers Awards for Research

✦ Announcement is made by the Lalor Foundation, Wilmington, Del. (*E.&M.J.*, June, 1936, p. 306), of the terms and conditions of five fellowship awards for $2,500 each that will be granted for the academic year 1937-38. Applications must be in the hands of the Secretary, C. Lalor Burdick, by Dec. 1, 1936, and appointments will be made in February, 1937.

The awards will be for research work in various fields of chemistry and related sciences. They may be used for work anywhere in the United States or abroad. However, as a memorial to the late Dr. Arthur A. Noyes, founder of the Research Laboratory of Physical Chemistry at the Massachusetts Institute of Technology, one of the awards

for each of the next four years will be specifically assigned to work at that institution.

Appointment is open to both men and women residents of the United States. No age limit is prescribed, but the usual range of ages will be between 25 and 40 years. Professors on sabbatical leave or other leave of absence are among those eligible for appointment. High intellectual and personal qualifications as well as creative ability and capacity for productive scholarship are essential elements in the appraisal of candidates. The qualifications of the candidates will be passed upon by an advisory board.

Idaho

Mill for Star Mine

✦ A 750-ton mill to treat the ores from the Star mine, at Burke, has been announced by James F. McCarthy, president of the Hecla company, following his return from the East. The mill will be constructed near the mine and will be modern in every detail. Plans for the structure were drawn by W. L. Zeigler, metallurgical engineer for Hecla. E. L. Woods, superintendent, will direct construction.

✦ The electrolytic zinc plant of the Sullivan Mining Company at Kellogg is operating at full capacity, producing 200 tons of a slab zinc per month. Ore is received from the company's Star mine, the Sidney mine, on Pine Creek, and the Bunker Hill and Hecla mills. Zinc mines in the district begin to show signs of activity, following several years of idleness due to low metal price.

✦ The Clayton Silver mine produced 1,018,175 lb. of lead and 66,365.4 oz. of silver covering the period from Aug. 1, 1935, to July 23, 1936. A year ago in August shipments averaged 50.5 per cent lead and 61.3 oz. of silver, whereas during July of this year shipments averaged 58 per cent lead and 85.9 oz. silver.

✦ The Charles Dickens shaft, through which the Silver Crescent vein will be opened at depth, has been unwatered to the 400 level, according to James Mohr, president of the company. Unwatering will continue to the 600-ft. level, from which point a crosscut south will be driven to the Silver Crescent.

✦ Hecla Mining reported to stockholders that it received $520,748.23 from ore sales during the second quarter. Operating expenses, taxes, and other costs amounted to $290,582.59. Net profit for the quarter, before provisions for income and capital stock taxes, was $183,436. Dividend checks of 15 cents per share, were mailed stockholders on August 15.

Australia

Gold Output Shows Large Increase

MORE MINES and mills coming into production

✦ The gold yield of Western Australia for the six months ended June 30, 1936, was 359,414 oz., which is 259,426 oz. more than in the corresponding period of last year. The New South Wales yield over the same period has increased 6,100 oz. to 26,705 oz. and the Victorian by 10,163 oz. to 52,211 oz. This rate of increase is likely to continue, as many plants have yet to come into production.

✦ The first ore-treatment unit, capacity 5,000 tons of oxidized ore monthly, on the Youanmi Mine, Youanmi, Western Australia, began operating in August. The second unit, of similar capacity, but for the treatment of sulphide ore, will be completed soon. Unwatering has been partly completed and the workings have been found to be in good order.

✦ Marvel Loch Development, N. L., operating at Marvel Loch, Western Australia, is to increase its capital from £100,000 to £200,000 by the creation of 1,000,000 new 2s. shares. An amalgamation with Great Victoria United, N. L., is to be effected. This latter company's mine is situated at Burbridge and contains at least 300,000 tons of low-grade ore. The Marvel Loch mill is to be increased to treat 5,000 tons monthly at an estimated cost of $13,500.

✦ The re-treatment of the Great Boulder dumps by Golden Horse Shoe (New), Ltd., is now in full progress. No. 1 dump contains 1,900,000 tons assaying 1.5 dwt. and No. 2 dump 1,000,000 tons assaying 1.03 dwt. The plant has been extended to treat 60,000 tons monthly.

✦ Yellowdine Gold Development, Ltd., Yellowdine, Western Australia, obtained 1,502 oz. from 3,109 tons for its first clean-up. The feed assayed 18.25 dwt. and the tailings, which are being stored pending the installation of a cyanide plant, 8.6 dwt. The mine is equipped with a 20-head battery.

✦ Western Mining Corporation, Ltd., reports that in the period June 2 to June 30 the ten-head battery at Cox's Find, Erlistoun, W. A., treated 717 long tons for 785 oz. valued at £6,732. The battery and cyanide plant has a capacity of 50 tons daily. Blocked reserves are estimated at 7,000 tons assaying 34 dwt.

✦ Great Boulder Proprietary Gold Mine, Ltd., Kalgoorlie, made a net profit of £70,636 for the year ended Dec. 31, 1935, compared with £86,672 in 1934 and £82,108 in 1933. The dividend in 1935 was equal to 25 per cent, requiring £58,334, the same as in 1934, but 12½ per cent lower than in 1933. Ore reserves at the close of the year were 697,394 tons assaying 6.8 dwt. These figures show an increase of 46,610 tons and a decrease of 0.5 dwt. per ton compared with the previous estimate. For the year the mill treated 128,990 tons of ore and 3,141 tons of clean-up material for a recovery of 82.4 per cent, or 8.52 dwt. per ton.

✦ The dredge of Cocks Eldorado Gold Dredging, N. L., Eldorado, Victoria, has been forced to cease operations temporarily because of failure of a number of the 12-cu.ft. chrome-steel buckets. From May 10 to July 16, the dredge dug 239,600 cu.yd., of which only 35 per cent was wash, for 12.6 tons of concentrates consisting of 6.0 tons of marketable tin concentrate and 144 oz. of smelted gold. Costs were 3d. per cubic yard.

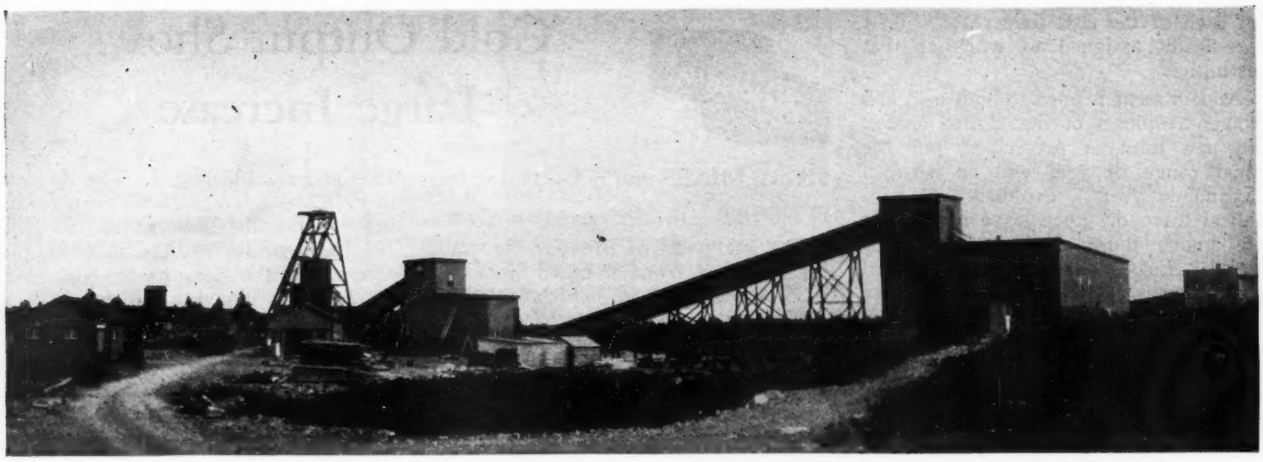
✦ Mount Morgan, Ltd., Queensland, expects to start operation of its new oxidized ore treatment plant in November. The capacity will be 22,400 tons monthly. More than 1,500,000 tons of oxidized ore are available, assaying 2.7 dwt. per ton.

✦ Golden Plateau, N. L., Cracow, has declared £441,000 in dividends since May, 1934. The latest monthly return to July 18 was 2,005 oz. from 3,669 tons, or 10.9 dwt. per ton.

✦ New Guinea Goldfields, Ltd., reports that scout drilling of the alluvials in the Wau area indicates the presence of ancient auriferous gravels underlying the more recent deposits. Gold has been found to a depth of 235 ft. In one hole from 205 to 226 ft. the value was 8s/1d. per cubic yard.

Fiji Islands

✦ The Emperor lode has been driven on for 300 ft. on the 190 ft. (bottom) level in payable ore. The width is over 30 ft. In addition to the true lode, flat sill-like "makes" similar to those in the top level occur and give a large increase in tonnage. Arrangements have been made with Charles Ruwolt, Pty., Ltd., for a treatment plant with a capacity of 10,000 tons monthly. For the four weeks ended July 11, 2,275 tons were treated for a yield of 1,050 oz. fine, equivalent to 9.2 dwt. per ton.



NOVA SCOTIA'S FIRST CYANIDE PLANT, operated by the Seal Harbor Gold Mines, started production in the middle of August. The flowsheet is similar to that of other properties in northern Canada and employs a rod mill, a jig, a classifier, an agitator, a thickener, and a filter. About 80 per cent of the coarse gold is caught in the jig concentrate. The gold is found in veins of flat dip, the latter lying in steeply dipping slates and quartzites. Oreshoots are from 7 to 60 ft. wide and 100 ft. long. The average value of the ore is $8, but mining and milling costs based on the 200-ton capacity of the plant are said to be low

Canada

British Columbia Mine Ships Nickel Ore to Japan

DEEPER DEVELOPMENT at Pioneer reveals consistent ore deposits—Deposit of cinnabar reported from Bridge River district

✦ A shipment of 500 tons of nickel ore, the first produced on the American Pacific Coast, was sent recently from the B. C. Nickel mine, near Choate, in the Hope district, to Japan, where it is understood purchasers will use it to test smelting and refining processes. The ore averaged between 4 and 5 per cent nickel and about 2 per cent copper, and was mined from higher than average grade deposits at the property. Development by diamond drilling and tunneling is being continued.

✦ A cinnabar deposit was recently reported found in the Bridge River district between Mud and Relay creeks, 14 miles from the south end of Lake Tyaughton. Preliminary prospecting is said to be under way by the Manitou Mining Company, Ltd., upon four zones of mineralization. C. P. Reil is managing director.

✦ In a recent statement, the president, Col. Victor Spencer, said that development at the new low levels at the Pioneer mine, Bridge River, has progressed sufficiently to indicate definitely that the width and grade of ore at greater depth are as good as in the upper levels, where estimates of reserves until now have been confined. The veins have been opened down to the 23d level, and a crosscut is being driven towards them from the shaft at the 26th, which is 3,200 ft. beneath the surface.

✦ Development at the Bralorne mine is being concentrated in the Empire section, now considered to be the most important of the property. In the Wedge tunnel, at a depth of 300 ft., ore has been opened in the Shaft vein for a distance of 400 ft., averaging about 0.4 oz. gold across a width of 3 ft.

✦ The capacity of the mill at the Island Mountain mine has been increased to 130 tons, compared with 70 tons last year, and it is now possible to treat lower-grade ore profitably. The shaft from the lowest adit tunnel has been sunk 250 ft. and will probably be continued to 500 ft. before lateral work is commenced.

✦ Machinery to increase the capacity of the mill from 30 to 80 tons was installed during August at the Vidette mine, near Savonia, in the Kamloops area. In July, 768 tons of ore was treated, and 548 oz. of gold, 800 oz. of silver, and 2,700 lb. of copper were produced.

✦ It is understood that encouraging results are being obtained at the Hedley Mascot mine, at Hedley, in the Osoyoos district. Milling was commenced in May at the rate of about 150 tons, but no detailed results will be published until operations are on a normal basis. It is stated, however, that earnings are higher than originally estimated and ore reserves appear to be more extensive than indicated by diamond drilling. W. R. Lindsay is in charge of operations.

✦ Cyanide equipment is being installed at the Dentonia mine, at Greenwood, at a cost of $23,000, with which it is intended to treat 50,000 tons of tailing on the dump and also the product from the present 100-ton flotation mill. According to the president, N. S. Smith, ore averaging about ⅓ oz. gold has been opened on the 500 level in the Rowe section for a distance of 180 ft. The width varies from 1 to 2½ ft.

✦ At the recent annual meeting of Sheep Creek Gold Mines, the superintendent, H. E. Doelle, reported that the Queen vein had been opened for 165 ft. at the tenth level, averaging 0.31 oz. gold across drift width. The Hideaway vein was recently encountered in a crosscut at the fifth level, parallel to and 1,100 ft. distant from the Queen vein.

✦ Four veins have been intersected in the long tunnel on the 1,850-ft. level at the Gold Belt, and their lateral development will be commenced shortly. Grattan Lynch is in charge, representing North American Mines Corporation, of Boston.

Quebec

✦ Francoeur Gold Mines, which shares with Arntfield a gold-bearing zone over 10,000 ft. long in the western part of the Rouyn area, has lately determined by drilling, at a distance of 2,000 ft. west of its shaft, where 40,000 tons of ¼-oz. ore has been developed, a shoot of ore of ½-oz. grade 10 to 20 ft. in width. The mine is thus assured of a profitable operation, like its neighbor, which is treating 175 tons a day for a moderate profit.

✦ Two miles to the northeast, the Aldermac mine and flotation mill are being prepared for an output of 500 tons a day, following the successful operation at Niagara Falls of a pilot plant for making elemental sulphur from pyrite. A. V. Corlett is manager of both Francoeur and Aldermac.

✦ Tiblemont Island, in the eastern part of the Harricana field, has now disclosed what appears to be a large tonnage of low-grade ore at and above the

500-ft. level. As the gold occurs in a most irregular way in small lenses and stringers in the granite rock, it has been unusually difficult to determine the average value. The property is being developed by Jules Labarthe for private owners in the United States.

Northwest Territories

✦ The province of Saskatchewan will soon have its first metal mining camp, on the north shore of Lake Athabaska. Four hundred miles to the southeast lies Flin Flon, whose orebody lies across the Manitoba-Saskatchewan boundary, with a small part in the latter province, which has given Saskatchewan its first output of metals. The first discovery in the summer of 1934 was taken over immediately by Consolidated Mining & Smelting, which drilled it and installed a mining plant in the summer of 1935. Two inclined shafts 1,270 ft. apart are now approaching 500 ft., and a zone 100 to 200 ft. wide and 2,000 ft. long is being explored to that depth. The gold-bearing zone is much longer than this. Preparations are now being made to install a mill unit of 500 tons' capacity.

✦ Adjoining the Consolidated property on the east is that of Athona Mines, where a similar zone is being developed. A 10-ton test mill has been in operation for the past year, showing values of $3.50 to $4 over a large area on the 125-ft. level.

Ontario

Matachewan Consolidated is doubling its mill capacity to 300 tons and has resumed sinking with a view to opening new levels at 500 and 650 ft. The 150-ton mill has been making $1 a ton operating profit from ore yielding $7.30 a ton. It is expected this will be increased to about $3 a ton when the mill is treating 300 tons daily.

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Deep Drilling in England For Oil

✦ Five more licenses have been granted to drill for oil in England, the Secretary of Mines announces. Two areas, in Sussex and Hampshire, comprising some 478 square miles, have been secured by the Anglo-American Oil Company. A well being drilled near Portsmouth by the D'Arcy Development Company, controlled by the Anglo-Iranian Oil Company, has reached a depth of 3,000 ft. It is expected to reach the oil formation between 5,000 and 6,000 ft.

Mexico

Mines in Lower California Reopened

ANTIMONY SHIPMENTS continue from Durango

✦ Late summer found the Mexican mining industry more active and with fewer labor troubles than when the season began. Several strike threats were withdrawn either as a result of the companies allowing demands, mostly for higher pay, or the Federal Labor Department inducing the disgruntled to talk things over with their employers. The Spanish situation helped exports to some extent. The Federal mineral reserves were expanded with the incorporation of two western tracts. There were some interesting court actions involving mining companies and tax agents.

✦ Cia. Minera de Calmalli, S. A., financed by Mexico City capital, has started working four gold-silver mines that were long idle in the Calmalli region, located in the central part of Lower California. First ore shipment of eight tons, assaying high in gold, has been made to the smelter at Santa Rosalia, L. C., from San Francisquito, on Los Angeles Bay, L. C., the mines' outlet.

✦ The National Supreme Court found that The Potosi Mining Company must pay the Ministry of Finance the 461,000 pesos (some $135,000 U. S.) which it claims as Federal tax on the company's Chihuahua production but that company need not pay the Chihuahua Government the 50,000 pesos it wants for a similar reason. Company sought an appeal from lower courts' decisions, contending that its Chihuahua franchise exempts it from these taxes. The high court ruled that though the concession exempts company from State levies, the pact does not apply to Federal imposts.

✦ Activities in the Velardeña district, Durango, consist of operating the Los Muertos mine by Juan M. Campos, and the former operator of that property, Luis Lujan, is starting work at the Terneras mine. The La Laguenra mine is being worked by Adolfo Gonzales.

✦ The Ministry of National Economy has included in the Federal mineral reserves free lands on the Michoacan Pafic Coast between the mouths of the Coahuayama and Balsas rivers.

✦ Mines in the Velardeña district, Durango, chief of which are the Los Palotes, operated by Republican Mining & Metal, are making considerable shipments of antimony. This mining is being extended westward from Velardena to the Nanzas River.

✦ Denying a petition of the American Smelting & Refining Company, to temporarily close its Matehuala unit, in San Luis Potosi, because the low price of silver makes operation unprofitable, the Federal Board of Conciliation and Arbitration did, however, allow the company to reduce pay of the unit's personnel by 35 per cent. When the price of silver exceeds 60c. (U. S.) an ounce, normal wage schedules at Matehuala must be resumed, the board ruled.

✦ Cia. Minera de San Jose, S. A., working in the Pachuca district, Hidalgo, announces June production of 8,171 metric tons, averaging 2.75 grams gold and 444 grams silver per ton. The May output was 7,911 tons that averaged 2.70 grams gold and 483 grams silver per ton.

✦ Tia Gerrada mineral lot, Mazatlan municipality, Sinaloa, has been included in the Federal mineral reserves because the concessionaire failed to live up to the franchise, the Ministry of National Economy announced.

✦ Federal Labor Department has sent an inspector to the San Juan de Guadalupe mining district, Coahuila, to seek settlement of a controversy between companies and workers over agitation for higher wages and new collective labor contracts.

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Bolivia

✦ Efforts of the Bolivian Government to better the general economic conditions of the country have resulted in a new decree regulating wages and salaries, and raising the price of gold. It is hoped that gold production will now increase and add more revenue, as the country has been practically dependent upon tin exports for foreign exchange. Bolivian gold production during the last few years has been very small, whereas silver production has been increasing and during 1935 the output was reported to be 5,800,000 oz.

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Chile

✦ During the last quarter of this year copper production in Chile will be slightly increased. The nitrate production has been maintained at a rate similar to that of 1935. During the first half of this year about 1,300,000 metric tons were produced. Gold placer operations so far have been below last year's figure, but gold production is reported at satisfactory levels.

South Africa

Huge Sums Available For Expansion on Rand

MANY COMPANIES plan large investments for machinery and development

✦ The Witwatersrand gold mining industry spent £22,755,341 on stores and equipment during 1935, says the latest report of the Government Mining Engineer, Dr. Hans Pirow. Of this sum nearly £3,000,000 paid for new plant and machinery. Thirty-eight vertical shafts, costing approximately £120,000 each, are now being sunk, and present mining activities on all parts of the Rand indicate that this rate of progress will be greatly exceeded in the next few years.

✦ One of the most progressive houses on the Rand, the Gold Fields Group, has undertaken large expansion programs on all its producing and non-producing mines. Expenditure on new plant and equipment at the Simmer & Jack mine amounted to over £450,000 during 1935. The milling capacity of Robinson Deep, the deepest mine in South Africa, has been increased to 110,000 tons. There are now twelve large mines developing ore or shaft sinking on the Far East Rand, which in the course of the next five years will require over £30,000,000 to bring them to the production stage.

✦ The Corner House Group, controlling the greatest number of Rand producers, is busy on important plans, the capital expenditures of which will run into several million pounds. To obtain access to ore lying at great depth, Crown Mines have spent over £3,000,000 on four vertical shaft systems. This amount was financed out of profits. The East Rand Proprietary Mines is in the forefront with a big construction and shaft-sinking program. Out of £485,789 spent last year on capital account, nearly £340,000 was expended on shaft sinking and hoisting equipment. To complete the present capital expenditure program for shaft sinking and surface and underground equipment, a further £1,210,000 will be required. The Durban Roodepoort Deep expansion and modernization program cost £483,929 in 1935 alone. Work recently undertaken at the City Deep will amount to over £600,000, chiefly in connection with the sinking of a new five-compartment vertical shaft. At the other mines of the group various plans are being developed, aiming at the achievement of the highest efficiency compatible with the maximum rate of milling.

✦ New works undertaken in connection with the mines of the Anglo American Group evince an equally progressive tendency. Foremost among the latest is the announcement of the completion of an entirely new reduction plant at the Springs Mines, the capital expenditure for last year totaling over £443,000. West Springs is now busy in opening up its southern area, and it is estimated that capital expenditure in this connection will be in the neighborhood of £400,000. Brakpan Mines are now busy with a capital program in the region of £100,000. Shaft sinking and equipment at Daggafontein absorbed over £264,000, and similar work at Sallies and East Daggafontein, two developing mines, amounted to £267,685 and £455,706 respectively.

✦ The tonnage and profits for July of the ten most important Rand producers are shown as follows:

July Production and Profit

Company	Tonnage	Profit
Randfontein	396,000	£156,261
Crown Mines.....	363,000	265,502
Government Areas..	223,000	279,051
Sub Nigel.....	59,000	201,016
New Modderfontein.	200,000	150,474
New State Areas...	127,000	158,059
East Geduld.....	120,000	136,589
Springs Mines	142,300	168,111
Daggafontein Mines.	128,000	127,068
Geduld	111,000	120,403

The total profit made by the Groups was £3,957,300, compared with £3,832,100 in June and £3,794,000 in May.

✦ Uganda's export of gold and tin has considerably increased this year, according to the half-yearly figures recently issued by the Commissioner of Mines at Kampala. Gold valued at £39,000 was exported from Uganda during the first six months of this year, compared with £27,000 for the corresponding period last year. The tin export for the first half of the present year exceeded that of last year by 35 tons. The gold produced came from 28 different alluvial undertakings. In 1935 the Uganda Government obtained £2,000 in royalties from gold exports and £4,500 in royalties from tin exports.

✦ Many milling records were broken by Rand Gold Mines during July, according to the official returns for the month. The record shows that 3,957,300 tons of gold-bearing ore went through the mills of the 33 largest Witwatersrand mines, reaching the highest level since May, 1933. Several companies have registered new tonnage records. Gold produced during July was 967,993 oz., or an average of 31,225 oz. per day. Natives employed in the Witwatersrand number 292,500, an increase of 2,368 since May. At $35 per oz. the Rand is supplying the world with $1,092,875 worth of new gold daily. This is expected to be increased to $1,150,000 before the year is over.

✦ The first of a series of subsidiaries of the West Witwatersrand Areas, the Libanon Gold Mining Company, has just been floated with a capital of £2,500,000 in 10s. shares. This marks the beginning of active large-scale mining on the newly discovered Far Western Rand. The Libanon Company has been granted a lease of the mining rights on approximately 3,484 claims situated to the west and southwest of Venterspost, another potential producer. The property has been proved by a number of borehole strikes, 3.5 dwt. over 54 in. being struck at a depth of 3,237 ft. last October. A jumper drill is testing the prospective shaft-site at the moment, and it is expected that shaft-sinking will soon begin. Among the directors of the company are Sir Ernest Oppenheimer, Sir Abe Bailey, W. A. Mackenzie, and G. Carleton Jones.

✦ Roan Antelope, whose production quota has been 4,200 long tons of copper monthly and is now increased to 4,500 tons, reports a working profit of £202,500 (43.8 per cent of its gross income of £462,500) for the quarter ended June 30.

✦ Rhokana Corporation reports that its estimated profit for the full year ended June 30 was £610,000, after interest, depreciation, and development, subject only to taxation. Production for the period is given as 25,057 long tons of blister copper and also 25,342 long tons of electrolytic copper. A dividend of 12½ per cent has been declared and a further 5 per cent is planned, which will make a total of 17½ per cent, against 12½ per cent paid last year.

✦ A blow to the confidence of those who are sinking shafts in the East and West Witwatersrand areas has been dealt by Marievale Consolidated. This company's No. 1 shaft has cut the Main Reef at a depth of 755 ft. and though the reef is 30.4 in. wide at the point intersected, it assays only 1.65 dwt. gold per ton. The hope remains that this will prove to be merely a lean spot in the Reef.

✦ The Government Banka tin mines sold 122,105 quintals of tin at an average of Fls. 148.36 per quintal (£2,480,000 at current rate of exchange) the first six months of 1936. The 1936 budget estimated sales for the full year as Fls. 150, and this has been exceeded in half the period.

✦ Witwatersrand Nigel has arranged to explore its Houtpoort area by sinking an incline along the reef from its present seventh level. It is intended to extend levels from this incline along the reef at suitable intervals.

PERSONAL ITEMS

Ira B. Joralemon, consulting engineer, is in Idaho on professional business.

Allen H. Rogers is spending a few weeks in the Southwest on professional business.

Dr. Otto Sussman has become a member of the board of Roan Antelope Copper Mines.

Sir Cecil H. Rodwell has been elected chairman of Gold Coast Associated Companies.

Nelson Dickerman has returned from a month spent in California and is now in Washington.

Charles Janin has returned to San Francisco from a professional trip to Montana placer fields.

L. W. Shaner, formerly of Benguet Consolidated, is now on the mine staff at Antamok Goldfields.

H. B. Whitmore, of the Merrill Company, San Francisco, left Australia on return to the United States at the end of July.

A. W. Hahn, consulting metallurgist, has returned to Salt Lake City, Utah, after a professional stay in San Francisco.

Robert Linton, consulting engineer, Los Angeles, has been appointed a member of the State Mining Board of California.

Dr. J. F. Wright recently made a geological examination of the property of Smelter Gold Mines, Ltd., at God's Lake, Manitoba.

Claude A. de Bernales has become managing director of Meekatharra Gold Mines, Ltd., operating properties in Western Australia.

Marshall D. Draper, consulting engineer, has been appointed general manager of the Lode Development Company, Auburn, Calif.

Dr. W. F. James, consulting engineer, will conduct an examination of the Kirkland Lake property of the Moffatt-Hall Mining Company.

R. W. Prouty, consulting mining engineer and geologist, Los Angeles, Calif., is in Tegucigalpa, Honduras. His address is care of the American Legation.

Frank L. Sizer, consulting engineer, has returned to his office in the Hobart Building, San Francisco, after an extensive business trip to Nova Scotia.

Prof. Alan M. Bateman, of Yale University, has returned to New Haven from a professional trip to Athabaska and Great Slave Lakes, and Idaho.

Patrick Duncan, Minister of Mines, recently opened a Government Miners Training School at the East Geduld mines, at Springs, in the Transvaal.

P. R. Asel, recently at the Globe plant of A. S. & R., Denver, Colo., is at San Juancito, Honduras, with the New York & Honduras Rosario Mining Company.

D. G. Stephen, until recently manager of Van Ryn Estates mine, is reported to have been appointed consulting engineer to the New Kleinfontein Company, Ltd.

Roger Pierce, who received his master's degree at Montana School of Mines in June of this year, is now acting as a shift boss at the Leonard mine, at Butte.

H. R. Plate has left Grass Valley, Calif., to resume engineering practice. His address for the time being will be 1215 Vancouver Ave., Burlingame, Calif.

SUBSCRIBERS to Engineering and Mining Journal are invited to notify the Editor of their professional activities—mine examinations, changes of address, new business connections, etc. Personal items of this character will be published in this department for the information of your friends and acquaintances in the mining industry.

Sydney H. Ball, of the firm of Rogers, Mayer & Ball, who recently returned from an examination in the West, is now in the Northwest on professional business.

Wendell Fertig, graduate of the Colorado School of Mines, has joined the staff of Baguio Gold. His experience has been in Colorado and in other Western states.

Robert T. Schultz has severed his connection with the Peru Mining Company, of Deming, N. M., and is now with the Manning Gold Mines Company, Fairfield, Utah.

James B. Chamberlain, formerly surveyor with the Fairbanks Exploration Company, Fairbanks, Alaska, has gone to Bolivia with Cie. Aramayo de Mines en Bolivie at La Paz.

T. O. Sieberling is temporarily engaged with the Missouri Bureau of Geology and Mines as field geologist. He recently completed a two-year contract in Colombia.

George H. Cliff, of the Sylvanite Gold Mines, Ltd., Kirkland Lake, Ontario, arrived in Western Australia in July to take up the position of metallurgist at the Big Bell Mine, Cue.

G. W. Hezzelwood, formerly superintendent of the drain tunnel at the Balatoc Mining Company, has become general superintendent for the Cabit Mining Association in the Bicol district, P. I.

Charles H. Thurman, well-known California consulting gold-dredging engineer, left Seattle for Alaska on Sept. 5. He will fly to the interior to inspect a gold-dredging prospect for a client.

R. R. Marshall has been appointed general manager in Australia for Sulphide Corporation, Ltd., which operates the Central Mine at Broken Hill and chemical works at Cockle Creek, N.S.W.

Dr. G. Grossman, well known geologist and geophysicist, is spending a few days in the Coeur d' Alene district in a general survey of conditions and devoting some attention to a check-up along the silver belt.

R. Sholto Douglas is now acting as consulting engineer to Harwick-Kirkland Gold Mines, Ltd., which has holdings in Bernard Township, Kirkland Lake area, and in the Sudbury district of Canada.

Raymond G. Travis has become foreman of the silver refinery of the International Smelting & Refining Company, in East Chicago. He will also act as engineer in the consulting department of the company.

J. Lansing White, formerly associated with the Anaconda Mining & Milling Company, Roubaix, S. D., is now general superintendent of Alma Syndicate, Inc., 707 First National Bank Building, Denver, Colo.

G. A. Broomell, formerly of the Benguet Consolidated staff, is now a member of the technical advisory staff of the Soriano interests. He is stationed for the time being at I. X. L., in the Masbate district, P. I.

A. R. Kinkel, Jr., formerly geologist for the Hudson Bay Mining & Smelting Company at Flin Flon, Man., has resigned to take a position as geologist for the Buffalo Ankerite Gold Mine, Ltd., at South Porcupine, Ont.

S. H. Lorain has been appointed mining engineer with the United States Bureau of Mines and stationed at Moscow, Idaho, from which point he will cover the Northwestern states for the mining division of the Bureau.

O. A. Willson and **J. L. Mitchell,** both of Salt Lake City, are mine shift bosses at San Mauricio, Philippines. **J. R. Needham,** of San Francisco, and **Homer Martin,** of Battle Mountain, Nev., are filling similar positions at United Paracale.

T. S. Davey has resigned his position as superintendent of the properties of the Phoenix Gold Mining Corporation at Grass Valley, Calif., to accept the position of manager of Sierra Consolidated Mines, Inc., at Wellington, Nev.

Charles A. Ordway, consulting mining engineer, has returned to Chicago from a visit to the Porcupine mining district of Ontario, where he examined the property of Nabob Gold Mines, Ltd., for interested New York and Michigan capital.

Norman John Anderson has been conducting mine examinations and metallurgical tests for mines in the Black Hills of South Dakota and Wyoming, with headquarters in Rapid City, S. D.

Joshua Green, chairman of the board of the Peoples Bank & Trust Company, Seattle, has been elected a director of the Sunshine Mining Company, taking the place made vacant by the resignation of Frank Eichelberger, former manager.

T. K. Prentice has been elected president of the Chemical, Metallurgical and Mining Society of South Africa for the ensuing year. **Dr. P. E. Hall, E. H. A. Joseph,** and **R. S. G. Stokes** are the new vice-presidents, and **J. V. Muller** has been elected treasurer.

Frank S. Parker, accountant at the Balatoc Mining Company for the past four years, is now connected with the Engineering Equipment & Supply Company of Manila as vice-president and office manager. **J. M. Wittler** is mine accountant at Balatoc now.

John Barrett arrived in Manila in June to join the staff of Masbate Consolidated as senior engineer. He has had extensive engineering experience in California mining camps, and was recently employed on both the Golden Gate and Bay Bridge projects in San Francisco.

J. Owen Ambler, American metallurgical engineer at Rio Tinto, in Spain, who was in the early part of the civil war in that country held captive, with others, on the mining property, was later reported to have been released and is presumably now outside the zone of hostilities.

J. F. Price, Jr., has severed his connection with the Cia. Minera Wemeco, S. A., at Parral, Chihuahua, where for the last six years he had been mine superintendent, and is now engaged in consulting mining engineering, with headquarters at Monclova, Coahuila, Mexico.

Dr. J. C. Warner, associate professor of theoretical chemistry and for the past ten years a member of the faculty of the chemistry department at the Carnegie Insitute of Technology, has been appointed associate professor of metallurgy at Tech, effective at the beginning of the fall term.

R. J. Ennis, general manager, McIntyre Porcupine Mines, Ltd., Schumacher, Ontario, Canada, recently completed 25 years of distinguished service in the employ of the company. His associates tendered a banquet in his honor and presented him with a set of sterling silver service plates.

J. B. Mawdsley, geologist, is reported to have been appointed managing director of Ceres Exploration, Ltd., and **Brian Doherty,** of Toronto, has been named as president of the company, which is conducting exploration and prospecting work in northern Quebec and in the Athabaska region.

N. S. McKenna, of Berkeley, Calif.; and **D. A. Davis,** of Los Angeles, are at Antamok Goldfields, and **S. W. Zoldok,** of Homer City, Pa., and **A. E. McLaughlin,** of Jackson, Calif., are at I. X. L. All are recent graduates of the University of California who arrived in Manila in July to join the Soriano interests.

A. W. Fahrenwald, dean of the University of Idaho School of Mines, has been granted a 60-day leave of absence for a trip to the island of Cyprus, in the eastern Mediterranean. His services as a research consultant have been engaged by the Cyprus Mining Corporation, an American concern with headquarters in Los Angeles.

C. J. Grobler has been appointed additional inspector of mines and **A. O. Auret** an additional assistant inspector of mines of the Bloemfontein district of Orange Free State, Union of South Africa. The recently enacted Free State Gold Law has gone into force. The new law is expected to stimulate prospecting and development activities.

James T. Hill, who, as superintendent of power plant for the Fresnillo Company at Fresnillo, Zacatecas, has described on pages 447 to 449 the new turbo-compressor recently installed by that company, writes that he has just changed his position and is now superintendent of power plant for the Fort Bend Utilities Company, at Sugar Land, Texas.

Edwin S. Winslow, who had been with the Montezuma Apex Mining Company at Nashville, Eldorado County, Calif., for the last 2½ years as a flotation operator, resigned recently to accept the position of shift boss at the property of the Cuban Mining Company, which is operating manganese mines in Oriente Province, Cuba, the office of the company being at Cristo, Oriente.

J. K. Gustafson, for the past two years geologist for Western Mining Corporation and Gold Mines of Kalgoorlie, in Western Australia, has been engaged by Zinc Corporation, Ltd., North Broken Hill, Ltd., and Broken Hill South, Ltd., to make a detailed study of the Broken Hill lodes. Dr. Gustafson was with the Hollinger mines, in Canada, prior to going to Australia.

V. V. Clark, placer mining engineer, has joined the staff of Marsman Company, and will be resident engineer at the Gold Pocket Mines in Nueva Ecija, in the Philippines. Mr. Clark is a graduate of Stanford University and has had wide experience in placer mining in North, South, and Central America. He came to the Philippines in February, 1936, to examine the Agusan Trust property in Mindanao, and completed the examination in June.

Guy Riddell returned to New York on Aug. 1 from an extended Mexican and Western trip, on which he examined a number of placer and lode gold properties for Detroit and New York interests. He was joined at Denver by **H. W. C. Prommel** for a three months' Keystone drilling of a large placer in Sinaloa. Several trips across the Sierra Madres were made by plane. At one of the properties in Chihuahua for which Mr. Riddell is general superintendent the 100-ton mill recently started was taken in almost entirely by plane.

OBITUARY

Michael Mulhally, Rhodesian pioneer mining man, died at Bulawayo in July last.

William Smith, well-known mining man of South Africa, died at Johannesburg on July 19 at the age of 75.

Claude I. McLaine, well-known mining engineer of Sonora, Calif., died there on July 20, at the age of 60.

Clarence L. M. Wickstrom, well-known mining engineer of the Northwest, died recently in Spokane, Wash.

A. I. D'Arcy, active in Nevada mining circles for almost 35 years, died in Los Angeles on July 22. He was 57 years old.

George W. Craven, president of Montana School of Mines from 1921 to 1928, died recently at Butte, Mont., at the age of 65.

George Saunders Smith, of the London Metal Exchange firm of George Smith & Sons, died on July 22 at the age of 72.

Colin Timmons, an old-time mining engineer and mine operator of the West, died in Los Angeles, Calif., in the latter part of June. He was 82 years old.

Sir Thomas Cullinan, discoverer of the Premier diamond mine, where the famous great diamond named for him was found, died in Johannesburg on Aug. 23. He was 74 years old.

Ralph J. Orynski, manager, Mexican Candelaria Company, Contra Estaca, Sinaloa, Mexico, was killed recently in an airplane crash at Durango, Mexico. Mr. Orynski was 46 years of age.

B. C. Yates, general manager of the Homestake Mining Company, died on Aug. 12 from the effects of a heart attack brought on by the occurrence of a serious fire on the company's properties.

LETTERS

Lithium in North Carolina

The Editor:

At the "Lincolnton Tin Mines," referred to by Frank L. Hess in his recent article, "Lithium in North Carolina" (*E.&M.J.*, July, 1936, p. 340), a legitimate effort is being made at this time to develop the mineral deposits that have been worked spasmodically for many years. These deposits occur in a series of pegmatite dikes which extend for a distance of 35 miles, the Lincolnton area being near the north end. Five or six distinct, paralleling dikes are found at this point. Cassiterite, the oxide of tin, is found in association with secondary quartz and mica in the dikes, the body of which is largely feldspar where unaltered and kaolin where weathered. The latter is the prevailing condition to a depth of 60 to 80 ft.

The western series of dikes contain little or no spodumene, the lithia-bearing aluminum silicate which is so ably discussed in the article by Mr. Hess. The eastern series of dikes, however, contain appreciable quantities of spodumene, and

it *is* in association with tin. This statement is at variance with the observations of Hess. In what is called the "Incline Dike," which has an average width of 27 ft., as well as in smaller, paralleling apophyses, we may say, roughly, that 15 to 20 per cent of the dike matter is spodumene. The tin content will average one-fourth of 1 per cent or more, with enriched zones as high as 2 per cent, and contact areas 5 per cent cassiterite.

It is planned to mine the North Carolina pegmatites for the tin, mica, kaolin, and feldspar content. With the amount of spodumene found in these deposits economically, it is hoped that research chemists and metallurgists may find added distinct and valuable uses for lithium as a metal or as a salt. When such utilization is effected, there will be added value to the pegmatites of North Carolina.

New York, N. Y. STUART ST. CLAIR

Has Anybody Seen "Blackie"?

The Editor:

From issue to issue of *E.&M.J.* and with feverish anxiety, I peruse the experiences of mining men from one end of the world to the other, and always the problem is solved in a "big way," which proves, I hope, that if I keep on reading the *Journal,* I too, will solve my problem in the same "big way."

It's funny how, after studying Dana religiously for a long time and noting that there are several hundred minerals to be found, and new ones being discovered every day, that I, a beginner, have so far not been able to find even a good grade of building stone. And here in Colorado, too. But let me tell you of my last venture in the mining game and the results. Then you tell me, ain't I cut out to be a miner, or is it just because I don't live right?

Now, to start with, I will have to go back and give you a little background. Uncle Charley used to haul ore up at Central City. He forgot to allow for space for himself between his wagon and the side of a bluff one cold morning when he was walking to keep warm. Age, thirty-seven years, two months, and five days. Uncle Frank used to work at the mines in Creede, Colo. He tried to clean some dirt out of a dynamite cap with a nail. He succeeded. He was two years older than Uncle Charley. Uncle Alton sold a lot of stock and built a hundred-ton mill up the Alamosa River. He forgot to tell his stockholders that he didn't have any ore, so now he is working for the State. So you see, I come from a line of great mining men. And, oh yeah! there was Uncle Will, who came to the Valley in the early days, and ran out of bullets for his old muzzle loader. So he just melted down some galena that he found on a ledge up Cat Creek way, and made him some more. Not until poor Uncle Will had been dead for a long time did we discover that the bullets he made were native silver instead of lead. So that brings me to my last venture in the mining game.

A year ago I located a big quartz vein away up on the ridge above Cat Creek right in the heart of the country where we have looked for years for Uncle Will's silver ledge. Never been dug in, either. I just knew that at last I had found the long missing lode, and in a few months at the most I would be driving one of those big brown sedans that the Rolls-Royce people make. With the greatest secrecy I did the location work and had the claim surveyed. I even got a surveyor from another county, and I made him take a solemn oath that he would never divulge the whereabouts of my great find to a living mortal. Then when everything was properly filed and recorded I told the world of my find. Every one congratulated me and told me what a lucky guy I was. One old-timer said that the very spirit of poor old Uncle Will had more than likely come back out of the past and guided me right to the very spot. Gee, it sure is a great sensation to awake and find the world at your feet proclaiming you a rich man.

Then came the task of naming this new mining company. I racked my mind, but no name could I think of that seemed to carry enough adjectives to do the mine justice, so finally I started my tunnel that was to cut the vein at about seventy feet depth, and decided that the Lord would provide a name when the right time came.

I worked in earnest. Day after day I pounded those drills through that old country rock. Day after day I would measure my progress with a yardstick, and how proud I was of that progress when I put it down in the official record book each night.

Two days before Christmas the formation commenced to change and the old drills got the jitters and jumped around in the hole something terrible. I knew that I was closing in on the "Mother Lode," and believe you me, anxiety kept me in a feverish sweat both night and day. I thought, how great is the goodness of the Lord to send me all these riches for a Christmas present. I promised myself I would bring her in on Christmas day. I worked hard those last two days, and put in some overtime besides, and I had a round of 48-in. holes well into the vein on Christmas eve.

That night a stray black cat came into camp and decided to make its home there. He was christened Blackie. And right there, whether you believe in black cats or not, things commenced to go wrong.

Early Christmas morning Blackie and I started to the tunnel to fire the last charge that was to make me rich. We went with solemn step, and enough powder to blow up a fort. With nervous hands I loaded those holes to the brim. I lit the fuse and started for the portal of the tunnel with Blackie by my side. Just as we came out into daylight a stray dog came up looking for sympathy. Blackie gave one look, did an about face, and went right back into that tunnel. There I was with a great love for life, and also there I was with Blackie, my good-luck symbol, headed for annihilation. I held my breath, then I called for Blackie. No Blackie came. Then the explosion—Whammmm!! . . . and before the vibration had died away, out of the entrance of that tunnel came Blackie, doing as near as I could estimate, about three miles an hour faster than Campbell did at Salt Lake. Poor Blackie. Here he came, there he went. Right out over the dump, hitting the ground about every fifteen feet, and with his tail straight in the air. No, that's wrong cause only half of his tail was there. Right on down through the timber he went. And when I last saw poor Blackie he was doing handsprings and about eighty miles an hour, and headed for the other side of the mountain and parts unknown.

Then I remembered the mine. I rushed into the tunnel shoving my little tram car ahead of me. What a shot I had fired. Looked like one of the rooms in the Carlsbad Caverns. And there was my vein. As beautiful a quartz vein as one ever set eyes on. And all through it were little metallic crystals. I loaded some samples into my little car and started for the portal of the tunnel. Native silver, I thought. I gave a yell and came out of that hole almost as fast as Blackie did. Couldn't stop the car when I came to the end of the track, and over the dump she went, samples and all. But who cared? Not I. I had made my first big find and I was walking on air. Back into the hole I went for more samples, and then for town at top speed.

Two days later my returns from the assay office came. My bubble had busted. No gold, no silver, some lead, but not in commercial quantities. Yep, I was just a poor busted prospector again. But, pardner, I wouldn't take a thousand dollars a day for those four or five days I was breaking into that vein. You won't understand unless you have really made a find yourself some time. Going over Niagara Falls in a tub would be tame compared to it. And I'm kinda glad it came out the way it did, too, 'cause now I'll get to go through it all over again some time.

Time cures all wounds. Only the other day a fellow came in out of the timber carrying some "float" he had picked up on Green Mountain. Gold tellurides. Forty four thousand dollars a ton. (I'm sure glad I didn't know there was ore like that when I hit that vein. I'd have died.) And this summer I'm going to run her down and show you some mining that really is. But that's another story, and I'll leave it till next time.

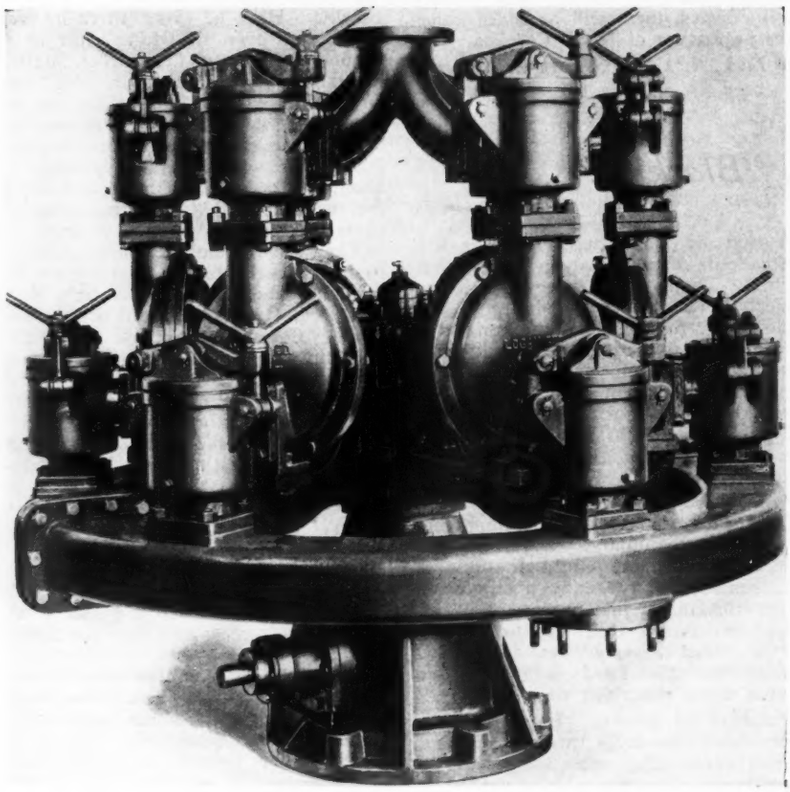
Well, pardner, what do you think. So long, and good luck! HAL BOUTWELL.

P. S. If you ever see a black cat that is gun-shy, with only half a tail, and that flying at half mast, let me know. Would like to square myself with Blackie if I could, 'cause it really wasn't my fault. H. B.

P. S. again. Gee, almost forgot. I got that little book you sent me the other day. "Successful Operating Ideas for Mine, Mill, and Smelter." Sure do like it, and it's going to make my next mine easier to dig. And, just in appreciation, I'm going to name my next big find "The E. & M. J. Mining, Milling, and Leasing Company." Believe me, that's gratitude. HAL.

Monte Vista, Colo.

EQUIPMENT NEWS



RADIAL DIAPHRAGM PUMP

The Logan Engineering Company, 4541 Ravenswood Ave., Chicago, announces a radial type of diaphragm unique in design. There are six pumping chambers arranged radially around a vertical nickel-steel drive shaft and carried on independent brackets attached to a main central housing. Each pumping chamber has attached to it an inlet valve and a discharge valve, these valves being identical and interchangeable. The valves are of the weighted rubber-ball type, being arranged for ready access by slackening a single-wing nut, and then swinging the valve cover open, permitting the valve cage to be withdrawn, carrying the ball with it. Inlet valves are connected to a ring manifold made in halves and arranged to be mounted so that the suction pipe may be placed at any one of six locations. The discharge valves connect with a streamlined spider manifold having six radial branches to connect with the respective valves, these branches converging into a central outlet at the top, from which piping may lead in any desired direction. Each pump chamber is said to be provided with a molded ring diaphragm clamped at its outer circumference to the pump chamber and at its inner circumference to a piston by means of steel rings. Each piston is connected by a rigid rod with a steel crosshead carried in adjustable cast iron V-guides. Each crosshead has at the end opposite the diaphragm a hardened-steel roller mounted on parallel roller bearings, carried on a hardened-steel pin fastened through the crosshead, and having the center line of the roller in line with the center of the diaphragm. Crossheads and rollers are operated by an annular "floating eccentric" which is said to impart positive motion to each crosshead in both directions (suction and discharge) and operates all six crossheads in a single plane from one crankpin, imparting to each diaphragm the same travel, and at evenly spaced time intervals, six individual pump strokes being taken during each revolution of the crankpin. The vertical shaft is driven by a pair of hardened-steel bevel gears running in an oil bath within the main housing. The drive shaft, which may be seen projecting from the side of the housing, near the base, is also of nickel steel, and both this shaft and the vertical crank shaft are mounted in Timken roller bearings, and the floating eccentric carried on the upper end of the crank shaft is also mounted on Timken roller bearings. Suitable adjustments are provided for each pair of these bearings, to take up any lost motion that might develop after a long period. The pump may be driven by a Gearmotor, or any other suitable form of drive, and where a variable rate of pumping is desired, it may be driven by a variable-speed motor or through a variable-speed transmission. This pump possesses the advantages of diaphragm pumps in general, and in addition is said to have many new features and occupies a small space.

An even torque is required so that a motor of the correct power will operate efficiently, as compared with the need of an oversize motor for pumps in which there are "peaks" and "valleys" in the cycle. The pump may be operated efficiently at any speed within its maximum recommended speed, even down to a mere crawl, and does not require priming for moderate height of suction. Starting dry, it is said to pull fluid into the pump in a few strokes. For pumping abrasives, sludges, and slimes, no friction parts are said to be affected, and the relatively low velocity of the fluid in passing through the pump minimizes wear on the interior surfaces.

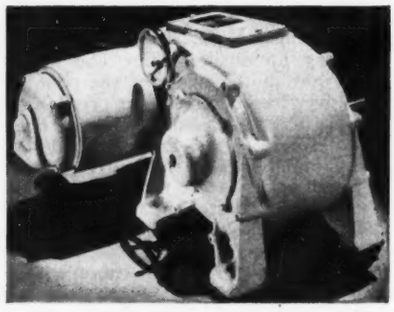
Patents are pending in the United States and foreign countries, and it is the intention of the Logan Engineering Company to manufacture the pump only in moderate sizes, as the company prefers to license other manufacturers to build the larger sizes. Already a number of foreign firms are said to be negotiating for the manufacturing rights.

Portable Volt-Wattmeter

A new combination volt-wattmeter of the Type AP-9 series of portable instruments, consisting of a voltmeter and a wattmeter fitted into a standard AP-9 case, has been announced by the General Electric Company, Schenectady, N. Y. Either rating may be used by throwing a switch located on the top of the instrument. The instrument is said to have an over-all accuracy of ¾ of 1 per cent of full-scale value. As with other Type AP-9 instruments, the new volt-wattmeter has magnetic damping, the new Permaloy moving vane, and is shielded from stray magnetic fields. The case is of Textolite.

Variable-Speed Power Unit

The Sterling Electric Motors, Inc., Telegraph Road at Atlantic Ave., Los Angeles, Calif., announce the manufacture of a new variable-speed motor with ratings from ¼ to 15 hp. The operating principle of the motor is simple and consists of a standard thickness medium width high-grade V-belt

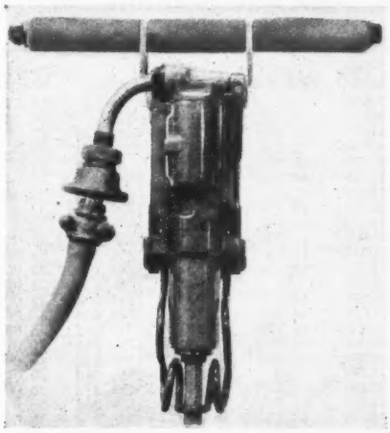


which is constructed exactly the same as standard endless V-belts with the exception of being a little wider. The belt runs on two simple, ingenious, rigid-type alloy-iron V-pulleys which are mounted on fixed, aligned, parallel, heat-treated alloy steel shafts mounted on liberal, high-grade, sealed ball bearings. Turning of a conveniently located handwheel is said to simultaneously change the diameters of both pulleys automatically, maintaining the proper belt tension.

Belt velocities are the same as those used for standard multiple V-belts. The motors can be assembled with either single or multiple reduction, standard Sterling Slo-Speed gears making available any speed desired at the output shaft. The feet can be left off, making the unit ideal for built-in machines, and the entire unit can be mounted in any position, shaft up, shaft down, with ring bases or flanges on bottom or top or both. These units can be furnished without motor or with a.c. or d.c. motors such as open, inclosed, fan-cooled, pipe-ventilated, explosion-proof, and 2, 3 or 4 speed.

45-Lb. Auger Drill

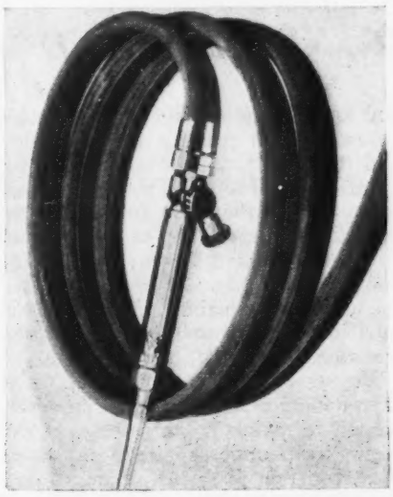
The Sullivan Machinery Company, Claremont, N. H., has recently announced the H-2 rock drill for performance in drilling soft material. By means of a simple change it is said it can be made into a machine which will give good performance in hard rock. The H-2 was



purposely designed for auger drilling and is therefore especially adapted for use in drilling soft iron ore, anthracite, gypsum, limestone, slate, shale, frozen ground, or any heavy, sticky formation, because of its stalling torque, resulting in an extra strong rotation. Stalling, consequently, is greatly minimized, and the result is said to be a superior auger drill. Features listed by the manufacturer are, superior drilling speed in auger conditions, ease of operation, and low upkeep cost.

Duplex Hose

A type of rubber tubing, or hose, of new construction has been placed on the market by the Electric Hose & Rubber Company, Wilmington, Del. It is especially designed for welding equipment and similar devices. Twin hose are simultaneously molded with a connecting web between them, so that a cross-section resembles the figure 8. A single length of this non-kinking hose is all that is necessary for equipment which heretofore has required two separate lengths. An additional advantage is said to be its construction, with a special cord-wound reinforcement between the first



and second braid, giving it a much higher burst limit than ordinary welding tubing. With the ¾-in. size the burst is 2,000 lb. This Supero construction is said to permit the use of differing pressures in each side without torque or writhing.

The hose is made with individual hose in different colors—red and black or red and green—or with both hose lines the same color. The connecting web may be cut with a carborundum wheel the distance required for attaching hose to separate outlets.

INDUSTRIAL NOTES

The Robins Conveying Belt Company has made a sales agreement with the Mine & Smelter Supply Company, of Denver, Colo., Salt Lake City, Utah, and El Paso, Tex., for the sale of Robbins equipment in the states of Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming, and in parts of Idaho, Nebraska, South Dakota, and Texas.

General Refractories Company announces the appointment of Braman, Dow & Company, Boston, Mass., as dealer agents in the Boston area.

Walter E. Hawkinson has been elected treasurer of Allis-Chalmers Manufacturing Company, Milwaukee, Wis., succeeding the late Raymond Dill.

Foster Wheeler Corporation and **General Regulator Corporation** have announced that a consolidation of the sales departments of the two companies has been completed. The distribution of General regulators will be made hereafter through the branch offices and agents of Foster Wheeler Corporation, and all communications may be addressed to that company. The sales headquarters of the General Regulator Corporation will be at the general offices of Foster Wheeler Corporation, 165 Broadway, New York, N. Y.

BULLETINS

Filters for Boiler Feed Water. R. P. Adams Company, 220 Delaware Ave., Buffalo, N. Y. Bulletin 401. On Adams filters. Pp. 6.

Insulating Refractory Concrete. The Quigley Co., 56 West 45th St., New York. Bulletin 320A on "Insulcrete." Pp. 4.

Spectrographic Analysis. A new catalog D-20 of Bausch & Lomb Optical Co., Rochester, N. Y., describing the theory and principles of design of quartz spectrographs and their use in the analytical laboratory for qualitative and quantitative analysis in routine or research work. Discusses types and selection of instruments.

Control Instruments. Brown Instrument Co., Philadelphia, Pa. An 8-page folder describing Brown potentiometer pyrometers for accurate temperature control. Also a 24-page booklet "Instruments from the Executive Viewpoint," emphasizing the fact that "To Measure and Control Is to Economize."

Cyanide Equipment. Denver Equipment Co., Denver, Colo. Bulletin No. 3623, describing thickeners, filters, diaphragm pumps and samplers.

Economics Institute, National Industrial Conference Board, New York, N. Y. A 24-page brochure announcing a new service to members of the Conference Board. The purpose is to personalize the resources of the Board and orient them to problems of individual companies.

Turbine Generator Sets from 10 to 400 kw. are described and operating advantages enumerated. Bulletin GEA-2295. General Electric Company, Schenectady, New York. Pp. 4.

Air Compressors. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Leaflet 2218 describing and illustrating "Ro Twin" Compressor. Pp. 3.

Variable-Speed Transmission. Reeves Pulley Co., Columbus, Inc. Booklet describing and illustrating hydraulic, mechanical, and electrical controls. Pp. 12.

Stopehamer. Ingersoll-Rand Co., 11 Broadway, New York, N. Y. Folder illustrating in section the design of a stoper with pneumatic rotation. Pp. 2.

Portable Cable. General Electric Co., Schenectady, N. Y. Bulletin GEA-1918A, contains data and listings of all types of tellurium, all-rubber Glyptal compound and braided types of portable cable for mining, welding, electric shovels, and dredges. Pp. 27.

Crushers. American Pulverizer Co., 1249 Macklind Ave., St. Louis, Mo. Booklet describing Type 5 American Ring Crushers. Pp. 7.

Detachable Bits. Sullivan Machinery Co., Claremont, N. H. Bulletin entitled "Sullivan Writes a New Chapter."

Oil Blast Circuit Breakers. General Electric Co., Schenectady, N. Y. Folder GEA 2326, illustrating and describing the new FH breaker in cubicles assuring safety to personnel and equipment. Pp. 4.

Transmission Equipment. Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill. Catalog No. 1500, devoted to power-transmission equipment. Pp. 208.

Magnetic Pulleys. Dings Magnetic Separator Co., Milwaukee, Wis. Catalog No. 25, describing and illustrating magnetic pulleys and magnetic separators. Pp. 34.

Alloy Metals. Colmonoy Co., Los Nietos, Calif. Bulletin No. 50, describes alloys, castings, and welding rods of wear-resisting overlay metals. Pp. 15.

Motors. Ohio Electric Manufacturing Co., Cleveland, Ohio. A well-illustrated brochure showing manufacturing operations in building fractional-horsepower motors. Pp. 16.

Portable Compressor. Ingersoll-Rand Co., Phillipsburg, N. J. Bulletin No. 2198 illustrating two-stage electric portable compressors driven either d.c. or a.c. on models from 15 to 75 hp. Pp. 3.

Heavy-Duty Roller Bearings. Fafnir Bearing Co., New Britain, Conn. This beautifully bound brochure is called Engineering Manual No. 35. It is a well illustrated indexed manual containing a summary of principles affecting the selection, application, and operation of anti-friction bearings, and it contains numerous tables of characteristics, dimensions, and capacities. This manual is available without charge to executives and engineers responsible for bearing selection or maintenance. Pp. 197.

SUMMARY OF

MONTHLY COMMENT . . . DAILY AND AVERAGE MONTHLY

GENERAL business activity in this country during August was the highest since early in 1931. The upward trend was reflected in continued buying of non-ferrous metals on a substantial scale and further strengthening of the price structure. The *E. & M. J.* index of non-ferrous metal prices advanced from 72.18 in July to 72.70 in August.

Copper in the world market advanced during August from 9.150c. to 9.400c., f.o.b. refinery basis. There were fairly liberal purchases for rearmament and some speculative buying. Moderate offerings of spot and near-by metal also were a factor. The strength abroad nearly resulted in a higher market here. Kennecott was not in sympathy with raising the price at this time, because of its low rate of operations at Utah, and let it be known that copper would be available in quantity at 9¼c., Valley, and that production is to be increased by about 3,000 tons. This development put a stop to the move to advance the price. Domestic sales of copper dur- August totaled 25,503 tons, against 175.- 484 tons in July. Abroad, however, the undertone remained firm, which was attributed chiefly to the tense political situation.

Buying of lead was almost as active as in the preceding month, but producers elected to maintain the price at 4.60c., New York, until definite signs appear of a reduction in stocks. Stocks of refined lead on Aug. 1 totaled 231,081 tons.

Zinc did little to attract attention until the very last day of the month. The market in Europe improved toward the close of August and sellers here strengthened their views. Early on Aug. 31 it became known that at least one important seller will advance the price 5 points. Demand suddenly became brisk, and before the day was over more than 30,000 tons were sold, virtually all at 4.80c. On the following day (Sept. 1) the price moved up to 4.85c.

Apprehension over the Spanish situation resulted in quite a sharp advance in the price of quicksilver. Domestic quotations at the close were nominal at $78@$80 per flask. Tin showed little net change for the month. Platinum advanced sharply on speculative purchases that threaten to disturb the entire industry. Producers of platinum are not in sympathy with outside operations in the metal. Cadmium was in better demand and tungsten prices advanced.

United States Market

1936 Aug.	Electrolytic Copper Domestic (a)	Copper Export (b)	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
1	9.525	9.150	42.750	4.60	4.45	4.80
3	9.525	9.150	43.000	4.60	4.45	4.80
4	9.525	9.175	42.875	4.60	4.45	4.80
5	9.525	9.200	42.800	4.60	4.45	4.80
6	9.525	9.200	42.750	4.60	4.45	4.80
7	9.525	9.225	42.375	4.60	4.45	4.80
8	9.525	9.275	42.375	4.60	4.45	4.80
10	9.525	9.300	42.625	4.60	4.45	4.80
11	9.525	9.350	43.300	4.60	4.45	4.80
12	9.525	9.350	42.750	4.60	4.45	4.80
13	9.525	9.350	42.625	4.60	4.45	4.80
14	9.525	9.400	42.375	4.60	4.45	4.80
15	9.525	9.425	42.375	4.60	4.45	4.80
17	9.525	9.375	42.125	4.60	4.45	4.80
18	9.525	9.325	42.000	4.60	4.45	4.80
19	9.525	9.275	42.600	4.60	4.45	4.80
20	9.525	9.275	42.400	4.60	4.45	4.80
21	9.525	9.275	42.250	4.60	4.45	4.80
22	9.525	9.300	42.250	4.60	4.45	4.80
24	9.525	9.300	42.250	4.60	4.45	4.80
25	9.525	9.300	42.125	4.60	4.45	4.80
26	9.525	9.300	42.375	4.60	4.45	4.80
27	9.525	9.325	42.700	4 60	4.45	4.80
28	9.525	9.350	42.875	4.60	4.45	4.80
29	9.525	9.375	42.875	4.60	4.45	4.80
31	9.525	9.400	43.250	4.60	4.45	4.80
Av. for month	9.525	9.297	42.579	4.60	4.45	4.80
Averages for Week						
Aug.						
5	9.525	9.150	42.833	4.60	4.45	4.80
12	9.525	9.283	42.696	4.60	4.45	4.80
19	9.525	9.358	42.350	4.60	4.45	4.80
26	9.525	9.292	42.275	4.60	4.45	4.80
Calendar Week Averages						
Aug.						
1	9.525	9.138	42.600	4.60	4.45	4.80
8	9.525	9.204	42.696	4.60	4.45	4.80
15	9.525	9.363	42.675	4.60	4.45	4.80
22	9.525	9.304	42.271	4.60	4.45	4.80
29	9.525	9.325	42.533	4.60	4.45	4.80

Silver, Gold, and Sterling Exchange New York and London

1936 Aug.	Sterling Exchange "Checks"	Sterling Exchange "90-day demand"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	5.01500	5.00500	(e)	19.5000	138s 8d	$35.00
3	5.01375	5.00375	44.750	Holiday	Holiday	35.00
4	5.01375	5.00375	44.750	19.5000	138s 7½d	35.00
5	5.01500	5.00500	44.750	19.5625	138s 7 d	35.00
6	5.02125	5.01375	44.750	19.5625	138s 6 d	35.00
7	5.02000	5.01125	44.750	19.6250	138s 6 d	35.00
8	5.02750	5.02000	(e)	19.6875	138s 4 d	35.00
10	5.02500	5.01750	44.750	19.5625	138s 5½d	35.00
11	5.02125	5.01375	44.750	19.5625	138s 6 d	35.00
12	5.02250	5.01500	44.750	19.5625	138s 5 d	35.00
13	5.02500	5.01750	44.750	19.5625	138s 4 d	35.00
14	5.02625	5.01875	44.750	19.5000	138s 4 d	35.00
15	5.02625	5.01750	(e)	19.5000	138s 4 d	35.00
17	5.02500	5.01625	44.750	19.5000	138s 5 d	35.00
18	5.02625	5.01750	44.750	19.4375	138s 4 d	35.00
19	5.03125	5.02375	44.750	19.3750	138s 2 d	35.00
20	5.03000	5.02125	44.750	19.1250	138s 2½d	35.00
21	5.03000	5.02250	44.750	19.1875	138s 3½d	35.00
22	5.03125	5.02375	(e)	19.3125	138s 2½d	35.00
24	5.03000	5.02250	44.750	19.3750	138s 2½d	35.00
25	5.03000	5.02250	44.750	19.5000	138s 2½d	35.00
26	5.03125	5.02250	44.750	19.5625	138s 2 d	35.00
27	5.03000	5.02250	44.750	19.5625	138s 2½d	35.00
28	5.02750	5.02000	44.750	19.5000	138s 4½d	35.00
29	5.03000	5.02250	(e)	19.5625	138s 2½d	35.00
31	5.03000	5.02250	44.750	19.5625	138s 3 d	35.00
Av. for month	5.02519	.....	44.750	19.490	.....	35.00
Averages for Week						
Aug.						
5	5.01521	.....	44.750	.....	.....	.....
12	5.02292	.....	44.750	.....	.....	.....
19	5.02667	.....	44.750	.....	.....	.....
26	5.03042	.....	44.750	.....	.....	.....

Calendar week averages: New York Silver, Aug. 1st, 44.750; 8th 44.750; 15th, 44.750; 22nd, 44.750; 29th, 44.750.

(e) No quotation (Saturday).

The above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis, add 0.225c. per pound, the average differential for freight and interest charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.300c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than the *E. & M. J.* average for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order issued April 24, 1935, the U. S. Government's price on newly mined domestic silver was established at 77.57. Handy & Harman's quotation for domestic silver, .999 fine, was 77c. per ounce throughout August.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125 per ounce.

THE MARKETS

PRICES OF METALS . . . MISCELLANEOUS QUOTATIONS

London Market

1936 Aug.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic Bid	Tin Standard Spot	Tin Standard 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
3				Holiday					
4	38.0625	38.3125	42.0000	185.2500	182.2500	16.3125	16.4375	13.8750	14.1250
5	38.0000	38.3125	42.0000	184.2500	181.2500	16.4375	16.5625	13.8750	14.1250
6	38.1250	38.3750	42.0000	184.0000	180.7500	16.4375	16.6250	13.5000	13.7500
7	38.3125	38.6250	42.2500	182.5000	179.5000	16.7500	16.8750	13.4375	13.6875
10	38.4375	38.6875	42.5000	182.2500	179.2500	16.8750	17.0000	13.3750	13.6875
11	38.5625	38.8125	42.5000	185.2500	182.2500	16.7500	16.8750	13.4375	13.6250
12	38.3750	38.6250	42.5000	184.2500	181.1250	16.6250	16.7500	13.3750	13.6250
13	38.6250	38.8750	42.7500	181.3750	178.0000	16.8125	17.0000	13.5000	13.7500
14	38.7500	39.0000	43.0000	182.5000	179.0000	16.7500	16.8750	13.5000	13.7500
17	38.3750	38.6875	42.7500	181.0000	177.7500	16.6875	16.7500	13.5000	13.7500
18	38.1250	38.3750	42.0000	181.0000	178.0000	16.5625	16.6875	13.4375	13.7500
19	38.1250	38.3750	42.2500	184.2500	181.2500	16.6875	16.7500	13.4375	13.7500
20	37.8750	38.1875	42.0000	183.5000	180.5000	16.5625	16.6875	13.3750	13.6250
21	37.9375	38.1875	42.0000	183.2500	180.2500	16.7500	16.8750	13.4375	13.6875
24	38.0625	38.3125	42.2500	183.2500	180.3750	16.8125	16.8125	13.4375	13.6875
25	38.0625	38.3125	42.2500	183.0000	180.0000	17.0000	16.9375	13.4375	13.6250
26	38.1875	38.5000	42.5000	183.0000	180.3750	17.1875	17.1250	13.5000	13.7500
27	38.3750	38.6250	42.5000	185.5000	183.0000	17.2500	17.3125	13.6250	13.8125
28	38.5000	38.7500	42.7500	186.5000	183.6250	17.1250	17.1875	13.7500	13.8125
31	38.3125	38.6250	42.7500	188.7500	186.1250	17.0625	17.0625	13.8125	13.8125
Av. for month	38.259	.....	42.375	183.731	.....	16.772	16.859	13.528	13.759

Current Prices—Miscellaneous Metals, Ores, and Non-Metallic Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated
(September 1, 1936)

Miscellaneous Metals

Aluminum, ingot, 99 plus per cent, lb.	19@21c.
Antimony, domestic, spot, lb.	11.750c.
Bismuth, ton lots, lb.	$1.00
Cadmium, lb.	75c@$1.05
Chromium, 97 per cent grade, lb.	85c.
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	30c.
Palladium, troy oz.	$24.00
Platinum, (official quotation) troy oz.	$62.00
Quicksilver, flask of 76 lb., 100 flasks or more	$78.00@$80.00
Radium, mg. radium content	$40.00
Selenium, 99.5 per cent, lb.	$2.00
Silicon, minimum 97 per cent, spot, lb.	16.50c
Tellurium, lb.	$1.75@$2.00
Thallium, 100 lb. or more, lb.	$6.50
Titanium, 96 to 98 per cent, lb.	$6.00
Zirconium, commercially pure, lb.	$7.00

Metallic Ores

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 45@47 per cent, c.i.f., long ton	$16.50@$16.75
Iron Ore, Lake Superior, long ton:	
Old Range bessemer	$4.80
Mesabi bessemer	$4.65
Old Range non-bessemer	$4.65
Mesabi, non-bessemer	$4.50
Lead (Galena) 80 per cent Joplin, Mo., ton	$49.00
Manganese Ore, c.i.f. Atlantic ports, long ton unit:	
52@55 per cent	26c.
49@51 per cent	26c.
44@47 per cent	25c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	42c.
Tungsten Ore, per unit of WO_3:	
Chinese duty paid	$15.25
Domestic Scheelite	$15.75
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton.	$31.00

Metallic Compounds

Arsenious Oxide (arsenic) lb.	3½c.
Cobalt Oxide, 70@71 per cent, lb.	$1.41@$1.51
Copper Sulphate, 100 lb.	$4.00
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb.	$1.29
Sodium Sulphate, bulk, ton	$13.00@$15.00

Alloys

Beryllium-Copper, Master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$30.00
Ferrochrome, 65@70 per cent chromium, 4@6 per cent carbon, lb.	10c.
Ferromanganese, 78@82 per cent, gross ton	$75.00
Ferromolybdenum, 50@60 per cent Mo, lb. of Mo contained.	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75@80 per cent, lb. of W contained	$1.30@$1.40

Non-Metallic Minerals

Asbestos, f.o.b. mines ton:	
Canadian (Quebec)	
Crude No. 1	$550@.....
Crude No. 2	$200@$225
Spinning fibers	$90@$150
Paper stock	$32.50@$37.50
Shorts	$11@$14.50
Vermont	
Shingle stock	$47.50.....
Paper stock	$35@.....
Cement stock	$23@.....
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 95 per cent $BaSO_4$, less than 1 per cent iron	$5.50
Bauxite, long ton:	
Domestic, chemical, 55@58 per cent	$6@ $7.50
Domestic, abrasive, 78@84 per cent	$12.50@$15.00
Dalmatian, 50@55 per cent	(a)$5.50@ $7.00
French, 56@59 per cent	(a)$6.50@ 7.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, bulk	$7.00@ $9.00
Delaware, No. 1	$14.00@.....
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85-5 per cent, all rail movement, ton	$18.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00@.....
Dead-burned, f.o.b. Washington	$22.00@.....
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	15@30c.
2 x 2 in.	30@50c.
3 x 3 in.	75@$1.00
3 x 4 in.	$1.00@$1.25
4 x 6 in.	$2.00@$2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.50
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@12½c.
Silica, water-floated, in bags, 325 mesh, ton	$16.00@$40.00
Sulphur, Texas mines, long ton	$18.00@.....
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$8.50@ $9.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$15.00@.....
200 mesh, cream colored	$25.00@.....

(a) Nominal.

Iron and Steel

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$20.00
Basic	$19.00
No. 2 Foundry	$19.50
Steel, base prices, Pittsburgh:	
Billets, gross ton	$30.00
Structural shapes, 100 lb.	$1.90
Bars, 100 lb.	$1.95

MONTHLY AND YEARLY AVERAGE PRICES

Silver and Sterling Exchange

	New York		London Spot		Sterling Exchange	
	1935	1936	1935	1936	1935	1936
January.....	54.418	47.250	24.584	20.250	489.207	496.115
February....	54.602	44.750	24.818	19.796	487.278	499.908
March.....	59.048	44.750	27.380	19.663	477.635	496.952
April.....	67.788	44.892	30.986	20.245	483.596	494.139
May.....	74.356	44.869	33.865	20.248	488.587	496.850
June.....	71.940	44.750	32.346	19.770	493.245	501.817
July.....	68.216	44.750	30.500	19.590	495.558	502.178
August.....	66.366	44.750	29.476	19.490	496.815	502.519
September...	65.375	.....	29.255	.....	492.917	.....
October.....	65.375	.....	29.368	.....	490.577	.....
November...	65.375	.....	29.284	.....	492.277	.....
December...	58.420	.....	25.563	.....	492.715	.....
Year.....	64.273	.....	28.952	.....	490.034	.....

New York quotations for silver not eligible for sale to U. S. Government, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange in cents.

Copper

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1935	1936	1935	1936	1935	1936	1935	1936
January....	8.775	9.025	6.583	8.358	28.077	34.706	31.261	38.788
February...	8.775	9.025	6.341	8.566	27.175	35.313	30.244	39.463
March.....	8.775	9.025	6.526	8.708	28.518	36.040	31.607	40.227
April.....	8.775	9.169	7.328	8.849	31.231	36.975	34.763	41.131
May.....	8.775	9.275	7.794	8.819	33.344	36.690	36.733	40.839
June.....	8.634	9.275	7.307	8.790	30.799	36.324	34.039	40.357
July.....	7.775	9.352	7.350	8.993	31.024	37.217	34.261	41.228
August.....	7.979	9.525	7.738	9.297	32.646	38.259	35.976	42.375
September..	8.504	.....	8.146	.....	34.036	.....	37.952	.....
October....	8.967	.....	8.514	.....	35.226	.....	39.609	.....
November..	9.025	.....	8.414	.....	35.229	.....	39.396	.....
December..	9.025	.....	8.414	.....	35.097	.....	39.313	.....
Year.....	8.649	.....	7.538	.....	31.867	.....	35.430	.....

New York quotations, cents per pound. London, pounds sterling per long ton (a) Bid quotation.

Lead

	New York		St. Louis		London			
	1935	1936	1935	1936	1935 Spot	1935 3 Mos.	1936 Spot	1936 3 Mos
January....	3.692	4.500	3.542	4.350	10.321	10.514	15.397	15.49
February...	3.528	4.515	3.378	4.365	10.216	10.413	16.022	16.141
March.....	3.579	4.600	3.429	4.450	11.012	11.188	16.608	16.767
April.....	3.692	4.600	3.542	4.450	12.231	12.459	16.097	16.234
May.....	3.962	4.600	3.812	4.450	13.861	13.940	15.530	15.601
June.....	4.020	4.600	3.870	4.450	13.776	13.806	15.170	15.259
July.....	4.123	4.600	3.973	4.450	14.451	14.511	15.856	15.954
August.....	4.254	4.600	4.104	4.450	15.774	15.792	16.772	16.859
September..	4.413	.....	4.263	.....	16.262	16.315	.....	.....
October....	4.512	.....	4.362	.....	18.209	18.209	.....	.....
November..	4.500	.....	4.350	.....	17.938	17.935	.....	.....
December..	4.500	.....	4.350	.....	16.803	16.828	.....	.....
Year.....	4.065	.....	3.915	.....	14.238	14.326	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

Tin

	Straits New York		Standard, Spot London	
	1935	1936	1935	1936
January.....	50.916	47.234	231.193	209.731
February.....	50.063	47.962	227.381	207.081
March.....	46.962	48.037	215.726	213.080
April.....	50.154	46.963	223.513	209.313
May.....	51.138	46.352	227.602	202.429
June.....	51.108	42.204	227.586	183.167
July.....	52.297	43.021	232.397	185.957
August.....	50.463	42.579	222.935	183.731
September.....	49.126	.....	223.929	.....
October.....	51.160	.....	226.891	.....
November.....	51.864	.....	226.452	.....
December.....	49.794	.....	220.075	.....
Year.....	50.420	.....	225.473	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1935	1936	1935 Spot	1935 3 Mos.	1936 Spot	1936 3 Mos
January.....	3.730	4.848	11.994	12.207	14.488	14.719
February....	3.714	4.859	11.819	12.000	15.125	15.391
March.....	3.894	4.900	12.095	12.250	15.983	16.190
April.....	4.030	4.900	12.891	13.128	15.181	15.334
May.....	4.220	4.900	14.534	14.685	14.536	14.777
June.....	4.299	4.880	13.734	13.898	13.896	14.122
July.....	4.325	4.783	14.065	14.185	13.579	13.826
August.....	4.535	4.800	14.714	14.938	13.528	13.759
September...	4.669	.....	15.414	15.616	.....	.....
October.....	4.825	.....	16.440	16.674	.....	.....
November...	4.850	.....	16.193	16.372	.....	.....
December...	4.850	.....	15.091	15.278	.....	.....
Year.....	4.328	.....	14.082	14.269	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Cadmium and Aluminum

	Cadmium		Aluminum	
	1935	1936	1935	1936
January.....	55.000	105.000	20.000	20.000
February.....	55.000	105.000	20.000	20.000
March.....	58.462	105.000	20.000	20.000
April.....	65.000	105.000	20.000	20.000
May.....	65.000	105.000	20.000	20.000
June.....	65.000	105.000	20.000	20.000
July.....	65.000	93.462	20.000	20.000
August.....	70.000	90.000	20.000	20.000
September.....	75.625	.....	20.000	.....
October.....	85.000	.....	20.000	.....
November.....	85.000	.....	20.000	.....
December.....	101.800	.....	20.000	.....
Year.....	70.491	.....	20.000	.....

Aluminum in cents per pound, 99 per cent grade. Cadmium, cents per pound.

Antimony, Quicksilver, and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1935	1936	1935	1936	1935	1936
January.....	14.111	12.736	72.760	76.769	34.000	36.885
February.....	14.250	12.967	72.500	77.000	34.000	35.000
March.....	14.250	13.072	72.500	77.000	32.846	34.115
April.....	14.029	12.673	72.500	76.731	32.000	32.846
May.....	12.712	12.410	72.135	74.940	32.000	32.000
June.....	12.500	11.707	71.460	74.192	32.000	36.346
July.....	12.500	11.245	70.538	73.423	32.000	39.308
August.....	12.500	11.125	69.000	73.923	31.333	49.577
September.....	13.177	.....	69.208	.....	36.000	.....
October.....	15.322	.....	71.750	.....	37.615	.....
November.....	14.217	.....	74.348	.....	38.000	.....
December.....	13.820	.....	75.200	.....	38.000	.....
Year.....	13.616	.....	71.992	.....	34.150	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce troy.

Pig Iron

	Bessemer		Basic		No. 2 Foundry	
	1935	1936	1935	1936	1935	1936
January.....	19.00	20.00	18.00	19.00	18.50	19.50
February....	19.00	20.00	18.00	19.00	18.50	19.50
March.....	19.00	20.00	18.00	19.00	18.50	19.50
April.....	19.00	20.00	18.00	19.00	18.50	19.50
May.....	19.00	20.00	18.00	19.00	18.50	19.50
June.....	19.00	20.00	18.00	19.00	18.50	19.50
July.....	19.00	20.00	18.00	19.00	18.50	19.50
August.....	19.00	20.00	18.00	19.00	18.50	19.50
September...	19.00	.....	18.00	.....	18.50	.....
October.....	19.00	.....	18.00	.....	18.50	.....
November...	20.00	.....	19.00	.....	19.50	.....
December...	20.00	.....	19.00	.....	19.50	.....
Year.....	19.167	.....	18.167	.....	18.667	.....

Iron in dollars per long ton. F.o.b. Mahoning and Shenango Valley furnaces.